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Marsh sandpiper *Tringa stagnatilis*, photographed on the north shore, about 1 km from the mouth of the Greenough River.

Photo: Mike Clarke

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CONTENTS

	Page
Fungi and Slime Moulds recorded in surveys at Kings Park and Bold Park – urban bushlands Perth, Western Australia. By Neale L. Bougher and Matthew D. Barrett	191
Shorebirds at Greenough River estuary and Southgate Beach, Western Australia. By Marcus Singor and Alice Bishop	252
Obituary: Daphne Joan Edinger	265
Obituary: Alexander John Saar	275
From Field and Study	281

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CONTENTS OF VOLUME 31
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CONTENTS OF VOLUME 31

Number 1, 25 November 2017

The first nesting observations of a potter wasp *Rhynchium superbum* (Vespidae, Eumenidae) – a recent eastern invader inhabiting the suburbs of Perth Western Australia. By Kit (Amy) Prendergast 1

A limestone subspecies of *Petrophile brevifolia* Lindl. (Proteaceae). By Bronwen Keighery and Greg Keighery 7

Avifauna of Underwood Avenue bushland, Shenton Park, Western Australia. By Ian Abbott and Margaret Owen 11

Evidence of pollination by sexual deception in the endangered spider orchid *Caladenia williamsiae*. By Ryan D. Phillips 36

Flora of the Swan Coastal Plain Foothills Part 2: Bancell Road Reserve. By Greg Keighery and Bronwen Keighery 44

Weedy and natural distribution of *Acacia trigonophylla* (Fabaceae). By Greg Keighery, Vanda Longman and Mark Brundrett 53

From Field and Study 63

Number 2, 25 May 2018

Extension of counts of Carnaby's Cockatoo (*Calyptorhynchus latirostris*) at two overnight roosting sites in metropolitan Perth. By P.F. Berry and M. Owen 67

Ursinia nana DC (Asteraceae) is naturalised in Western Australia. By Greg Keighery and Bronwen Keighery 78

Intra and interspecific interactions involving *Mergolossa rubricata* at bee blocks in urbanised south-western Australia. By Kit (Amy) Prendergast 82

Basking behaviour in Tiger Snakes, *Notechis scutatus* (Elapidae) at Herdsman Lake, Western Australia. By Paul Orange 89

Swan coastal plain studies: Taxonomic notes on *Bossiaea eriocarpa* Benth. and *Bossiaea ornata* (Lindl.) Benth. (Bossiaeeae: Fabaceae). By Greg Keighery 95

First Western Australian specimen of House Swift (*Apus nipalensis*) with notes on its distribution and migration. By R.E. Johnstone and B. Greatwich 105

From Field and Study 113

Number 3, 30 January 2020

Honeyeaters taking Marri sap on Gooseberry Hill. By Michael Brooker 115

Swan Coastal Plain studies: Status of the subspecies of *Grevillea curviloba* McGillivray (Proteaceae): A critically endangered plant. By Bronwen Keighery, Greg Keighery and Andrew Brown 119

First Australian specimen of Fairy Pitta (*Pitta nympha*) with notes on its distribution and migration. By R.E. Johnstone, B. Greatwich and G. Swann 128

A rare subspecies of *Apium prostratum* L. (Apiaceae) from Western Australia. By Greg Keighery 133

Flora of the Swan Coastal Plains Foothills 3: Vascular flora of Korijekup Conservation Park, Harvey. By Greg Keighery and Bronwen Keighery 137

Flora of the Swan Coastal Plains Foothills 4: Vascular flora of the Yarloop townsite reserves. By Greg Keighery and Bronwen Keighery 159

An unusually coloured Tiger Snake, *Notechis scutatus* (Elapidae) from Herdsman Lake, Western Australia. By Paul Orange 180

Obituary: Margaret Helen Brims 182

Evidence of plastic consumption by a Tiger Snake (*Notechis scutatus*) from a highly urbanised wetland. By Damian Lettoof and Katherine Orton 187

Number 4, 31 August 2020

Fungi and Slime Moulds recorded in surveys at Kings Park and Bold Park – urban bushlands Perth, Western Australia. By Neale L. Bougher and Matthew D. Barrett 191

Shorebirds at Greenough River estuary and Southgate Beach, Western Australia. By Marcus Singor and Alice Bishop 252

Obituary: Daphne Joan Edinger 265

Obituary: Alexander John Saar 275

From Field and Study 281

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FUNGI AND SLIME MOULDS RECORDED IN SURVEYS AT KINGS PARK AND BOLD PARK – URBAN BUSHLANDS PERTH, WESTERN AUSTRALIA

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ABSTRACT

Field surveys at Kings Park since 2009 and at Bold Park since 1999 yielded a total of 532 fungi (mainly macrofungi) and 28 slime moulds. Morphological studies and DNA sequence analyses of vouchered specimens from the surveys enabled 460 of the fungi and 25 of the slime moulds to be identified to species level, assigned species phrase names or designated "sp." with an accompanying brief macroscopic descriptor. Many of the species were previously not known to occur in the parks or in the greater Perth region, and some of the fungi had not previously been recorded in Australia and/or Western Australia. At least 19 fungi assigned with phrase names are considered to represent species new to science (rationale briefly outlined herein for those). Only 31% of the fungi, and 36% of the slime moulds, have been verified as occurring at both parks.

INTRODUCTION

Kings Park and Bold Park are regionally significant urban bushlands of the Swan Coastal Plain. Kings Park has 267 ha of bushland situated 1.5 km from the Perth CBD. Bold Park is about 4 km closer to the coast and has about 437 ha of mostly bushland. The parks have a diverse flora of 756 species of native and exotic plants (Barrett & Tay 2005) and provide significant flora and fauna linkages with adjacent and nearby bushlands. Kings Park and Bold Park also have a large diversity of fungi representative of the fungal flora in the broader Swan Coastal Plain and south-western regions of Western Australia.

Fungi and slime moulds were poorly known at Kings Park prior to the commencement of an initial survey contracted by the Botanic Gardens and Parks Authority (BGPA) in 2009. Previously, sporadic and uncoordinated efforts had documented mostly unvouchered and therefore unverifiable scientific names (Bougher 2010). The first two surveys of Kings Park fungi in 2009 and 2010 recorded 124 fungi and 14 slime moulds, contributing to a total of 168 fungi and 26 slime moulds identified to species level at that park (Bougher 2011). Five subsequent annual surveys of fungi were undertaken at Kings Park between 2011 and 2017. Each year of survey at Kings Park captured many new records for the park, e.g. 20% of the records in 2017 were new (Bougher 2017a).

Very few fungi had been recorded at Bold Park prior to the commencement of an initial survey contracted by the BGPA in 1999 which identified 120 species (Bougher 1999a). Subsequently, 10 annual surveys of fungi were undertaken at Bold Park between 2002 and 2016. As with Kings Park, each year of survey at Bold Park captured many new records for the park, e.g. 32% of the records in 2016 were new (Bougher 2016).

This paper provides a listing of the fungi and slime moulds recorded from Kings Park and Bold Park to date, based on morphological and molecular studies of vouchered specimens from the contracted surveys.

METHODS

Fungi and slime moulds were surveyed at Kings Park and Bold Park by the senior author in conjunction with volunteer community members and BGPA staff. For fungi, the surveys mainly focused on macrofungi – those producing structures (usually fruit bodies) clearly visible to the naked eye. Most microfungi are observable only with the use of a microscope, but a few that produced conspicuous moulds were recorded (designated as MO in Table 1) such as *Coniochaeta* aff. *lignicola* (see Fig. 1). The types of macrofungi recorded in the surveys include those with fruit bodies in the generalized form of brackets (designated as BR in Table 1), cups and disks (CD), corals (CO), cushions (CU), flasks (FL), jellies (JE),

mushroom-like (with a stem and centrally placed cap, MU), puffballs and earthballs (PF), pustules (PS), skin or crust-like growths often referred to as resupinate fungi (RE), shells, fans and spoons (SH), and truffles which have underground fruit bodies (TR). Also included are cyphelloid fungi (CY) which often produce crowded colonies of minute fruit bodies, such as by the Miniature Chimney Pots fungus *Henningsomyces candidus* (see Fig. 15), and rust fungi (RU) which are parasitic fungi usually visible as small pustules or conspicuous deformities on plants, such as *Uromycladium morrisii* which causes galls on *Acacia saligna*.

Seven annual surveys of fungi were undertaken at Kings Park between 2009 and 2017 (2009, 2010, 2011, 2012, 2015, 2016, 2017). Eleven annual surveys were undertaken at Bold Park between 1999 and 2016 (1999, 2002, 2003, 2004, 2005, 2007, 2008, 2009, 2010, 2011, 2016). Details of the survey sites, protocols, and results were compiled in the reports produced each survey year for BGPA. All reports are referenced in Bougher (2017a) for Kings Park and Bougher (2016) for Bold Park. At Kings Park four repeat-visit sites representing different vegetation types were surveyed each year (see Table 1 in Bougher 2011). At Bold Park 14 of the 31 major vegetation types and plant communities were surveyed for fungi (see Table 1 in Bougher 1999a), but not all of them were surveyed during each survey year, e.g. seven of them were surveyed in 2016. In addition, other areas in the parks were visited to enable representation of areas of more disturbed areas such as recently burnt bushland.

Representative specimens of taxa considered to be previously unseen during earlier survey events were collected, macroscopically described, photographed, and vouchered for permanent lodging at the Western Australian Herbarium (PERTH). Micromorphological attributes of the vouchered specimens were studied to help determine their identity. Nuclear ribosomal ITS and nLSU gene sequences were produced and analysed from selected samples of fungi from the surveys. DNA sequencing followed the methods for extracting and amplifying ITS of Anderson *et al.* (2016), except that the extraction buffer used polyvinylpyrrolidone (PVP) rather than polyethylene glycol (PEG), and primers used were ITS1, ITS1-F, ITS2, ITS3, ITS4 and ITS4-B for ITS, and LR0R, LR5 and LR7 for nLSU (Vilgalys 1992). No slime moulds were sequenced. Newly generated DNA sequences from the samples were submitted to NCBI GenBank (DNA accession numbers at GenBank are given in Table 1 following the PERTH specimen barcode of the voucher).

DNA sequence analyses together with morphological studies enabled many of the vouchered specimens from the surveys to be identified to species level. We apply the term "aff." (abbreviation from the Latin *affinis*) in cases where all the data we have available concurs that there is a close but imprecise

relationship to a formally named species. In cases where some data indicates similarity but the data to hand is either insufficient and/or conflicting, we apply the term "cf." (abbreviation from the Latin *confer*, meaning compare) to draw attention for comparison to a named species. Many other specimens that were not assignable to formal species were designated "sp." followed by an accompanying brief macroscopic descriptor in brackets. These are cases where further investigations on the voucher specimens beyond those undertaken by us to date are required to determine whether they represent a published species or a species new to science. The brief macroscopic descriptors are limited as a means on their own to convey the distinctiveness of the fungi as many of the fungi do not have greatly distinctive macro-morphologies. Instead such fungi may be distinguishable primarily by differences in their microscopic features and DNA sequences. For example, for *Tubulicrinis* sp. A, B, and C (see Table 1) the descriptors convey minor differences between their simple resupinate growths, but the three species differ substantially more from each other microscopically (spores, cystidia).

In some other cases of specimens that were not assignable to formal species, our investigations to date have strongly indicated these are likely to represent species new to science. For those, we have assigned phrase names in accordance with the format and guidelines used by the Western Australian Herbarium (Chapman 2007). It is anticipated that the phrase names will be listed on the Western Australian Herbarium specimen database (WAHERB) and on Florabase (https://florabase.dpaw.wa.gov.au). Descriptive data for the vouchers (mainly macroscopic descriptions of fresh specimens, sometimes with at least some microscopic data) are recorded in the Western Australian Herbarium specimen database (WAHERB) and become accessible on-line in publicly available databases such as Florabase, and the Australasian Virtual Herbarium (https://avh.chah.org.au/). Macro- and micro-morphological images of the voucher specimens from this study are not yet included in the databases but are available together with associated extra notes from the current authors upon specific case by case request.

RESULTS

Diversity

Overall, 532 fungi and 28 slime moulds were recorded during the surveys at Kings Park and Bold Park. However, this total includes 75 names referable to groups encompassing unknown numbers of unidentified species. Those group names are designated in a broad sense and consist of multiple, superficially similar specimens. Specimens assigned to these groups were not studied sufficiently during this work to confidently assign them a unique or formal identity at species level, and they are not considered further in this paper. Further studies may confirm

the distinctiveness of particular specimens in the groups or in some cases may determine their conspecificity with species listed in Table 1.

A total of 460 fungi (Table 1) and 25 slime moulds (Table 2) from the surveys at Kings Park and Bold Park have been identified to species level, assigned species phrase names, or designated "sp." with an accompanying brief macroscopic descriptor. In conjunction with drawing upon data from morphological studies, the designation of fungal collections as species, phrase names, or "sp." was aided by 194 DNA sequences that were newly generated for this study from 182 samples (different collections). Those sequences, together with 31 previously published sequences that were derived from specimens collected during the surveys [*Amanita* (13 sequences/2 samples), *Asproinocybe* (2/1), *Inocybe* (13/5) and *Mallocybe* (3/1)], supported or resolved the identity of 153 of the fungi recorded in the surveys from the parks (GenBank accessions are given in Table 1).

Kings Park had 312 fungi and 21 slime moulds, and Bold Park had 300 fungi and 13 slime moulds. Only 31% (152) of the 460 fungi and 36% (9) of the 25 slime moulds have been verified at both parks. Among the 460 fungi, the majority (77%, 358) were saprotrophic. Only 21% (99) were mycorrhizal, and 2% were pathogenic (9 or 10 species, depending on whether *Omphalotus nidiformis* is considered a weak pathogen or a saprotroph). Half of the species of fungi (50%, 232) were found on dead wood such as logs and other coarse woody debris, and 41% (190) were among leaf litter. Seven fungi were found exclusively on recently burnt ground, e.g. two species of *Anthracobia*. Of the different forms of fungi recorded, those with mushroom-like fruit bodies were the most diverse (43%, 198). Resupinate fungi (21%, 97) exceeded more conspicuous wood-inhabiting groups such as bracket fungi (5%, 23). Fifteen truffle-like species were recorded either deep within soil, e.g. *Chondrogaster* sp., shallow under litter, e.g. *Hydnangium carneum*, or emerging and becoming mostly uncovered, e.g. *Gymnogaster boletoides*.

Some of the fungi (122) and the slime moulds (6) recorded in the surveys at Kings Park or Bold Park, and in some cases specific collections of them vouchered from the surveys, are illustrated in a recent local field guide – Fungi of the Perth Region & Beyond (Bougher 2017b), as indicated in Tables 1, 2. For some of these fungi the names in Table 1 differ from the names in the field guide because their identity has been revised. For example, *Hebeloma cavipes* voucher PERTH8073155 (Table 1) is named *Hebeloma crustuliniforme* on page J-73 of the field guide; *Russula balpinea* PERTH7679645 is given as *Cystangium balpineum* (p. I-1); *Suillus granulatus* PERTH8073163 is given as *Suillus collinitus* (p. K-7); *Gyroporus* aff. *cyanescens* (page K-3 of the field guide) recently has been published

as *Gyroporus occidentalis* (Davoodian *et al.* 2019).

New records

Fungi recorded from the surveys at Kings Park and Bold Park previously unrecorded in Australia at the time include (Figs. 2–4, 6):

- A stalked cup fungus – *Martininia panamaensis* (Fig. 2). This unusual fungus was observed at Bold Park in 2009. Its fruit bodies consisted of brown/grey discs seated upon wiry brown stalks emerging from black sclerotia deeply embedded within the central branch of a rotting leaf frond of *Macrozamia fraseri.*
- A brightly coloured mushroom-like fungus – *Tricholomopsis scabra* (Fig. 3). This species was recently described from New Zealand (Cooper & Park 2016) for specimens previously referred to as *T. rutilans.* The DNA sequence from Kings Park confirms the presence of *T. scabra* in Australia; it is likely that *T. rutilans* does not occur in Australia.
- Some ink cap fungi e.g. *Coprinellus callinus, C. pyrranthes, Parasola auricoma* and *P. hercules* (Fig. 4).
- *Melanoleuca tristis.* In other parts of the world this species is known to favour gardens and other sites disturbed by humans, and it is probably widespread in similar situations in Australia. ITS sequences are identical to a sequence from the type specimen of *M. tristis,* KP192280, and other specimens reported in Antonín *et al.* (2017).
- One of the most diminutive mushroom-like fungi – *Hemimycena hirsuta.*
- Some inconspicuous wood-inhabiting fungi such as *Aphanobasidium gaspesicum, Litschauerella gladiola* (Fig. 6), *Odonticium septocystidia* and *Propolis farinosa.*

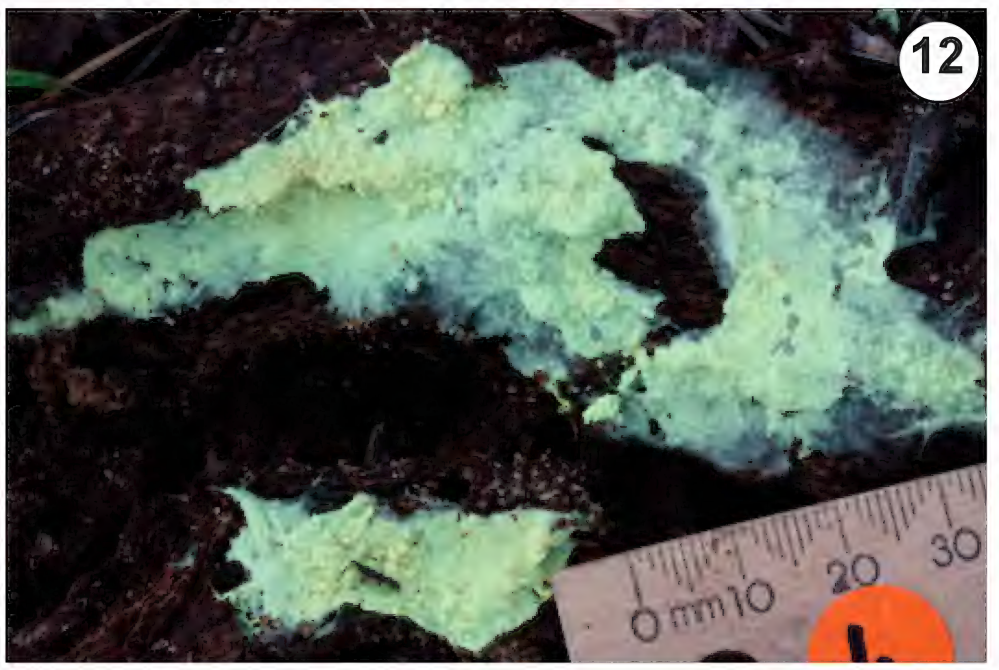
Some other fungi recorded at Kings Park and Bold Park were previously recorded elsewhere in Australia but were unrecorded in Western Australia. They include (Figs. 7–10, 12):

- The emergent truffle-like fungus – *Gymnogaster boletoides.*
- Some cup/disc fungi e.g. *Arachnopeziza aurata* and *Hyaloscypha hyalina.*
- Some mushroom-like fungi, e.g. *Coprinellus angulatus* (Fig. 8), *Cortinarius ardesiacus* (Fig. 9), *Lentinellus tasmanicus* (Fig. 10), *Leucocoprinus americanus* (Fig. 7), *Melanoleuca exscissa, Mycena fumosa* and *Pluteus perroseus.*
- Some resupinate fungi such as *Ceriporia tarda, Hyphoderma assimile, Skeletocutis amorpha, Tomentellopsis echinospora* (Fig. 12), *Trechispora microspora* and *Tubulicrinis calothrix*

Morphological attributes and DNA sequences indicate that some of the fungi from the surveys are likely to represent species new to science pending further investigation. They include the following 19 fungi that have been assigned phrase names:

Figures 1–6. Examples of fungi recorded in the surveys at Kings Park and Bold Park, including some species unrecorded in Australia before the surveys (Figs. 2–4, 6): **1.** *Coniochaeta* aff. *lignicola* PERTH8944601 (NLB1522) – a parasitic microfungus producing brightly-coloured mould growths on birds nest fungi; **2.** *Martininia panamaensis* PERTH8475350 (E9411) – a rare species of stalked cup fungus collected in Bold Park sprouting from black sclerotia embedded within the central branch of a rotting leaf frond of *Macrozamia*; **3.** *Tricholomopsis scabra* PERTH8944547 (NLB1517) – recently described from New Zealand, locally probably mis-identified as *T. rutilans*; **4.** *Parasola hercules* PERTH8944229 (NLB1488) – one of the many widespread but often overlooked small ink-cap fungi; **5.** *Leucoagaricus* aff. *badhamii* PERTH8871973 (NLB1434) – has white gills which bruise red upon touch; **6.** *Litschauerella gladiola* PERTH8700702 (NLB1119) – an inconspicuous wood-inhabiting resupinate fungus with some distinctive microscopic features.

- *Coprinopsis* sp. Peach pileus (N.L. Bougher & S. Easton NLB911). Young fruit bodies of this species are pastel peach-coloured, and therefore quite unusual among the ink cap fungi which are mostly white or grey when immature. It is phylogenetically closest to *Coprinopsis clastophylla* (based on ITS sequences, phylogenies not shown), which in nature is known from unique asexual fruit bodies (Vrinda *et al.* 2012 and references therein), although sexual fruit bodies have been artificially produced in culture.
- *Coprinopsis* sp. Large, stangliana-like (N.L. Bougher NLB1424). This species is morphologically similar to *C. stangliana*, but the ITS sequence is consistently 94% similar to this and also *C. strossmayeri* and *C. rhizophorus*. A description of Australian specimens can be found in Bougher (2006). This large and conspicuous fungus was considered an exotic species in that paper because of its apparent recent invasion in the Perth region and because it was accepted as *C. stangliana* (with some morphological discrepancies noted and pending DNA studies). However, the new ITS sequence data and recent evidence of its occurrence in other parts of Australia (equivalence not yet verified), suggest it may be native to Australia.
- *Dendrominia* sp. Large white patch on tuart (N.L. Bougher NLB1479) and *Dendrothele* sp. Small white patches on tuart (N.L. Bougher NLB1478). These species are phylogenetically placed in the order Trechisporales, without clear affinity to any previously sequenced genus. Although these collections are referred to as *Dendrominia* and *Dendrothele* here due to morphological similarities, they must eventually be placed in other genera because the type species of those genera do not belong in Trechisporales.
- *Descolea* sp. Broad-spored (N.L. Bougher & K.J. Tullis NLB1038). This species has broader spores than other locally found species of truffle-like *Descolea* (formerly *Descomyces*), and confirmation of its determination awaits DNA sequencing data.
- *Eichleriella* sp. Yellow scabs (N.L. Bougher E9320). This species appears to be none of the species treated under an expanded concept of *Eichleriella* (Malysheva & Spirin 2018).
- *Hohenbuehelia* sp. Hairy (N.L. Bougher & P. Robertson NLB514). This species is typical of the genus *Hohenbuehelia* with a strongly gelatinised pileus. However, it is not typical of most species of *Hohenbuehelia* as its pileus is covered with long hairs. Further collections and DNA sequences are needed to help resolve its identity.
- *Hydropus* sp. Blue-green cap (N.L. Bougher & P. Wilshaw NLB1550). This is an attractive



Figures 7–12. Examples of fungi recorded in the surveys at Kings Park and Bold Park, including some species unrecorded in Western Australia before the surveys (Figs. 7–10, 12): **7.** *Leucoagaricus americanus* PERTH9178392 (NLB1632) – a large species with bright yellow and red bruising reactions; **8.** *Coprinellus angulatus* PERTH8474826 (E9470) – an ink-cap fungus which possibly favours burnt ground; **9.** *Cortinarius ardesiacus* PERTH8690863 (NLB1125) – previously known from Tasmania; **10.** *Lentinellus tasmanicus* PERTH8475814 (E9405) – another Tasmanian species, also probably widespread in WA; **11.** *Ceriporia* aff. *spissa* PERTH8872929 (NLB1458) – the bright colour of this resupinate species contrasts with its habitat on blackened burnt wood; **12.** *Tomentellopsis echinospora* PERTH8690650 (NLB1095) – forms greenish-yellow resupinate fruit bodies.

species discovered during the survey at Kings Park with its fruit bodies in a clump attached to the base of an *Allocasuarina fraseriana*. ITS and nLSU sequences are closest to species of *Hydropus sens. lat.*, but few species of *Hydropus* have been sequenced to date, and generic limits compared to other genera of Porotheleaceae such as *Leucoinocybe* and *Gerronema* are not yet resolved.

- *Inocybe* sp. AU92 false murrayana (N.L. Bougher NLB1121), and *Inocybe* sp. AU92 small spores (N.L. Bougher NLB1146). These species represent new species not included in Matheny & Bougher (2017). Morphological and DNA sequence data indicates they are affiliated with the *Inocybe fibrillosibrunnea* group which also includes two other species from the surveys – *I. clypeata* and *I. froudistii*.
- *Pogisperma* (informal name) sp. Orange gleba (S.Q. Bolsenbroek H7544). This species is currently referred to as *Pogisperma* – an unpublished genus name currently applied to some truffle-like fungi. Recent DNA sequencing has begun to reveal a broad range of phylogenetic affinities among the "Pogispermas" and it is likely that representatives will belong to at least several new genera.
- *Porpoloma* sp. Olive-red cap (N.L. Bougher & M.J. Bougher NLB1062). The ITS sequence of this species is 95% similar to an unpublished sequence of a *Porpoloma* from Australia (GenBank Acc. KP311412), and 91–92% similar to the closest sequenced, named species of *Porpoloma*.
- *Purpureocorticium* sp. Cream (N.L. Bougher NLB 1531) and *P.* sp. Dried Mustard (N.L. Bougher & Y. Broome NLB 1389). These are the first records in Australia of the recently described (Wu *et al.* 2018) wood-inhabiting genus *Purpureocorticium*. That genus is currently known from a single described species, defined in part by having very small spores and brown to purple colour change in KOH. The genus is very different from any known genus, and DNA sequences produced to date indicate it could be a member of Gloeophyllales, Polyporales or some other order.
- *Rhizocybe* sp. Cinnamon pileus (N.L. Bougher, *et al.* E9044). This is the first record of the genus *Rhizocybe* for Australia, although several species are known from New Zealand. *Rhizocybe* has *Clitocybe*-like fruit bodies and is also characterized by the presence of conspicuous rhizomorphs (Alvarado *et al.* 2015).
- *Rhodocollybia* sp. Leather brown (N.L. Bougher NLB1147). The ITS sequence of this species is divergent (81–90% similarity) from any published *Rhodocollybia* sequences (the closest being *R. prolixa*, *R. brevipes* and *R. badialba*), but many species have not yet been sequenced. Several collections

Figures 13–18. Examples of fungi recorded in the surveys at Kings Park and Bold Park, highlighting some other forms of fungi: **13.** A bracket fungus (designated as BR in Table 1) *Ganoderma australe* PERTH8690723 (NLB1102) – produces large hard-woody fruit bodies on various trees; **14.** A cushion fungus (CU) *Trichoderma gelatinosum* PERTH8095744 (E9206) – produces gelatinous cushion-like fruit bodies that are bright yellow when young and develop green dots when mature; **15.** A cyphelloid fungus (CY) *Henningsomyces candidus* PERTH7679629 (E8109) – often referred to as Miniature Chimney Pots, produces crowded colonies of minute tubular fruit bodies; **16.** A rust fungus (RU) *Uromycladium morrisii* PERTH8945136 (NLB1569) – produces grotesque galls and deformities on *Acacia saligna*; **17.** A shell fungus (SH) *Crepidotus eucalyptorum* PERTH7680821 (E8223) – produces large numbers of fruit bodies particularly on tuart trees (*Eucalyptus gomphocephala*); **18.** A truffle (TR) *Reddellomyces westraliensis* PERTH8473617 (NLB543) – has spherical white or cream fruit bodies shallowly buried in the soil and often partially exposed. The truffle shown on the right is cut in half to show the maze-like fertile interior.

of this species have been found at Kings Park nearly always buried deeply below thick coverings of sheoak needle litter. The long narrow stipes are often co-joined at the base and embedded into well-rotted bark attached to the base of an *Allocasuarina fraseriana*.

- *Rickenella* sp. Pearly, hygrocybe-like (N.L. Bougher E9358). This species is stouter than typical *Rickenella* species, and morphologically more like *Hygrocybe*. Phylogenetically it is strongly supported as sister to the South American species *R. minuta*, which together are sister to the remaining species of *Rickenella* (data not shown), but is only 87% similar in sequence, indicating it is a very divergent species, of potential biogeographic interest. Unlike most *Rickenella*, this species does not seem to be associated with mosses, but rather has been found emerging from sandy soil in areas burnt within the previous 6 to 12 months. The sister species *R. minuta* has been demonstrated to be ectomycorrhizal (ECM) (Korotkin *et al.* 2018), and the trophic state of *R.* sp. Pearly, hygrocybe-like should be investigated to determine if it is also ECM. Generic rearrangements within the *Rickenella* clade may be warranted, given the morphological and ecological diversity contained within *Rickenella* as currently conceived.
- *Sistotrema* sp. Grey paint on leaves (N.L. Bougher & P. Wenham NLB1402). This species belongs to Cantharellales, and probably conforms with *Sistotrema*, but is only 83% similar in ITS sequence to the closest sequenced *Sistotrema* species.
- *Sistotrema* sp. Yellow flaps (N.L. Bougher E9396). This is a morphologically distinctive species of *Sistotrema* requiring DNA sequences to confirm its status.

DISCUSSION

A total of 560 different fungi and slime moulds reported in the current assessment is a large increase from previously published data for the parks, particularly for the fungi. For example, the number of fungi identified to species level for Kings Park reported in this article (312) well exceeds the number of species of fungi (168) previously reported (Bougher 2011). An increase is also evident with the slime moulds, e.g. three of the 21 species of slime moulds from Kings Park reported in this article (*Acyria riparia*, *Diachea leucopoda*, and *Perichaena depressa*) had not been reported previously (Bougher 2011) for that park.

The survey data indicates a low percentage of commonality between Kings Park and Bold Park – 31% of the identified fungi and 36% of the slime moulds. The low values may be mainly attributable to the limited and

incomplete survey effort to date which is evident by the continuing accumulation of records of novel species in each of the subsequent surveys at the parks. Higher percentages of commonality are likely to be reached after further surveys. The parks may be expected to harbour at least some different fungi, as they have some different plant species and vegetation communities (Barrett & Tay 2005) which in turn may affect the occurrence of particular fungi.

Most of the species of fungi observed during the surveys at Kings Park and Bold Park are likely to be indigenous to the local area, but some species are exotic. Undoubtedly exotic fungi include mycorrhizal associates of *Pinus* such as *Rhizopogon* spp., *Suillus* spp. and *Inocybe rufuloides*. Similarly, *Hebeloma cavipes* occurs near *Pinus* at Bold Park, and *H. crustuliforme* occurs near *Quercus* at Kings Park. *Puccinia myrsiphilli* is a rust fungus introduced into the region to help eradicate bridal creeper (*Asparagus asparagoides*), a widespread weed in Kings Park and Bold Park. *Melampsora euphorbiae* is another exotic rust fungus observed during the surveys – found on castor oil plants (*Ricinus communis*). Possibly introduced fungi include some of the species occurring (and often abundantly fruiting) in woodchips and gardens such as *Parasola conopilea* and *Tapinella panuoides*, and some less conspicuous resupinate fungi favouring *Pinus* wood such as *Coniophora olivacea*, *Hydnomerulius pinastri* and *Leucogyrophana pseudomollusca* (locally the latter in particular can be found also on litter and wood from native plants). Recent arrivals to Perth in the past few decades, include fungi which are generally more prevalent in humid areas further north, such as the green-gilled *Chlorophyllum molybdites* which is now widespread throughout the Perth region and further south (Bougher 1999b). Also see the note given above about the apparent recent invasion in the Perth region of *Coprinopsis* sp. Large, stangliana-like.

The finding of many species from the surveys at Kings Park and Bold Park previously unrecorded in Australia and/or Western Australia is not surprising as it is symptomatic of the current low level of knowledge about local fungi. Strikingly, such first records include some particularly large and conspicuous fungi that are quite well known elsewhere, such as *Leucoagaricus americanus* (Fig. 7). Also, in view of the low knowledge level, it is not surprising that a number of species new to science have been found during the surveys. Some of the fungi recorded during the surveys have been formally named and published only recently, e.g. *Amanita wadjukiorum* (Davison *et al.* 2013), *Asproinocybe lyophylloides* (Lebel *et al.* 2020), *Gyroporus occidentalis* (Davoodian *et al.* 2019) and several species of *Inocybe* (Matheny & Bougher 2017). Such species are not unique to Kings Park and Bold Park. Nor are most of the species recorded at these parks to date. Many are known to occur

widely in the south-west region of WA and/or beyond.

The high diversity of resupinate fungi recorded during the surveys at Kings Park and Bold Park (97 species – 21% of the species of fungi recorded) supports a contention that their diversity in the region may be greater than generally recognised. Resupinate fungi in the region (and elsewhere in Australia) have been under-collected and under-studied because they are inconspicuous and often have superficially similar fruit bodies. Not only is it likely that there are many more to be discovered, but they appear to be more diverse than the currently recognized taxonomic and phylogenetic breadth of resupinate fungi. For example, PERTH8871930, a resupinate fungus collected from Bold Park during the surveys, has an unremarkable cream-coloured smooth surface similar to that of many others. It is not listed in Table 1 because morphologically (macro and micro) it does not strongly match any particular genus or family, and DNA sequences indicate it is phylogenetically unplaced even to the level of Order. Hence, we submitted sequence data to GenBank (ITS+nLSU: MT571666) under the broad name "Agaricomycetes sp."

Currently it is not possible to accurately determine the number of fungi and slime moulds from Kings Park and Bold Park. The tally of 560 different fungi and slime moulds recorded from the surveys to date must be considered as an estimate. It includes 75 names referable to groups encompassing unknown numbers of unidentified species which have not been studied in detail. The total number of known species could be increased if additional species are resolved from those groups, or the number may be reduced if taxonomic studies and further collections necessitate the merging of groups. Also, numbers remain uncertain because currently there are a further 48 fungi recorded before the surveys began but not re-collected. Some of those fungi may have been overlooked, e.g. some of the slime moulds recorded from Kings Park by Jordan *et al.* (2006) and *Quambalaria coyrecup* – a well-documented pathogen of *Corymbia ficifolia* at Kings Park (Paap *et al.* 2008). However, many of the historical records are of variable accuracy, and some are unvouchered and not verifiable (see discussion by Bougher 2010).

The current tally, and the likelihood of many more novel records from further surveys, suggests there are likely to be more than 600 species of macrofungi. In addition, the parks are likely to have many hundreds of species of microfungi, only a few of which were recorded during the current surveys because protocols were focused on macrofungi. Therefore it seems likely that more species of fungi than plants (756, Barrett & Tay 2005) occur at Kings Park and Bold Park. Such figures may also apply to other comparable bushlands of the Perth region

and the broader Swan Coastal Plain region. More accurate determination of fungal and slime mould diversity at Kings Park and Bold Park and the level of commonality between these and other bushlands will require comparative surveys undertaken over many years.

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Table 1. Fungi identified to species level, assigned species phrase names, or designated "sp." with an accompanying brief macroscopic descriptor from field surveys at Kings Park and Bold Park.
Phrase names are given in a format used by the Western Australian Herbarium (PERTH) , i.e. the collector and collection number are given in brackets after the descriptor.
Forms*:** **BR** = bracket; **CD** = cup/disc; **CO** = coral; **CU** = cushion; **CY** = cyphelloid; **FL** = flask; **JE** = jelly fungus; **MO** = mould; **MU** = mushroom-like; **PF** = puffball/earthball; **PS** = pustules; **RE** = resupinate; **RU** = rust; **SH** = shell/fan/spoon; **TR** = truffle. ***Ecology/Life modes *(putative in most cases)*: **S** = saprotrophic; **P** = pathogenic; **M** = mycorrhizal. ***Microhabitat types*:** **A** = animal; **B** = bark of living tree; **BG** = burnt ground/litter; **D** = dung; **DT** = diseased or dying tree/plant; **DW** = dead wood/logs; **L** = leaf litter or soil; **MB** = moss on bark of living tree; **MG** = moss on ground, wood or rocks; **U** = underground.
***Kings Park and Bold Park codes*:** arbitrary, unchanging numbers assigned to each unique taxon. PERTH numbers in bold correspond to collections from Kings Park or Bold Park illustrated in the field guide *Fungi of the Perth Region & Beyond* (Bougher 2017b). DNA sequences are indicated following the PERTH barcode that is voucher for the sequence.
***GenBank accession numbers*:** those in bold are for newly generated DNA sequences from the present study; numbers not in bold are GenBank accessions from other sources. In some cases, the ITS and nLSU were amplified using non-overlapping primers and have separate GenBank accession numbers. When overlapping fragments were sequenced the assembled contiguous sequence was submitted under a single GenBank accession number and is indicated here as "ITS+nLSU".

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Agaricus campestris L.	MU	S	L	KP236	8872791	BP001	**8072698**, 8566496, 8871612	J-53 (**8072698**)
Agaricus rotalis K.R. Peterson, Desjardin & Hemmes	MU	S	L	KP414	8944989 (**ITS+nLSU: MT537115**), 7680481, 9178341		-	J-31 (7680457)

Agaricus subrufescens Peck	MU	S	L	KP132	8566046	-		J-54 (7680473)
Agrocybe pediades (Fr.) Fayod	MU	S	DW	KP362	759317, 8944288, 8944970 **(ITS+nLSU: MT571662)**	BP004	7680120, 8871485	J-1 (7680430)
Aleurina asperula (Rifai) Korf & W.Y. Zhuang	CD	S	L	-		BP226	7679653	
Aleurina ferruginea (W. Phillips) W.Y. Zhuang & Korf	CD	S	L	KP064	8478325	BP005	7611897, **7679211**	A-1 (**7679211**)
Aleurodiscus mirabilis (Berk. & M.A. Curtis) Höhn.	RE	S	DW	KP024	8476845	BP006	7589581	R-3 (7680074)
Amanita basiorubra O.K. Mill.	MU	M	L	KP149	8944326	-		
Amanita cf. *conicobulbosa* Cleland	MU	M	L	KP122	8477876	BP007	8353123	J-32 (7698828)
Amanita cf. *umbrinella* (E.-J. Gilbert & Cleland) E.-J. Gilbert	MU	M	L	KP255	8478090	-		
Amanita drummondii E.M. Davison	MU	M	L	KP057		-		
Amanita fibrillopes O.K. Mill.	MU	M	L	KP058	8477752, 8477760, 8477795	-		J-60 (8072388)
Amanita ochroterrea Gentilli ex Bas	MU	M	L	KP071	7587562	-		J-96 (8059632)
Amanita preissii (Fr.) Sacc.	MU	M	L	KP043	7587589, 8475490, 8477841, 8690766 (ITS: KY290657–KY290661, 28S: KY290654, RPB2: KY288484, β-tubulin: KY273105, EF1-α: KY273109), 8774765	BP022	8474842; EMD 29-2010	J-58 (8072434)

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Amanita sp. A (white with ellipsoid, amyloid spores)	MU	M	L	KP427	EMD 28-2010, EMD 30-2010 (E. Davison collections)	-		
Amanita sp. B (white with cylindrical, amyloid spores)	MU	M	L	KP428	7547722, EMD 27-2010 (E. Davison collection)	-		
Amanita sp. C. (yellowing bulb, sour odour)	MU	M	L	KP121	8477868	-		J-61 (8092206)
Amanita wadjukiorum E.M. Davison	MU	M	L	KP070	8565228, 8403988 (ITS: KF258719-KF258722), 8699496, 8699518	-		
Amanita xanthocephala (Berk.) D.A.Reid & R.N. Hilton	MU	M	L	KP256	8944555 **(ITS: MT571657)**	BP024	7659857, **8073198**	J-55 (**8073198**)
Amphinema byssoides (Pers.) J. Erikss.	RE	M	L	-		BP026	8872031	O-1 (7679874)
Annulohypoxylon bovei (Speg.) Y.M. Ju, J.D. Rogers & H.M. Hsieh	FL	S	DW	KP353		BP396	8072817, 8565767	
Anthracobia melaloma (Alb. & Schwein.) Arnould	CD	S	BG	KP050	8473803, 8690944, 8691045	-		
Anthracobia muelleri (Berk.) Rifai	CD	S	BG	KP184	8690952, 8691053	BP506	7650418	

Aphanobasidium gaspesicum (Liberta) Jülich	RE	S	DW	KP196	8691223, 8944458 (**ITS+nLSU: MT537096**), 8945012 (**ITS+nLSU: MT537116**)	-		
Arachnopeziza aurata Fuckel	CD	S	DW	KP034	8475709	BP028	**8095612**, 8565260	A-7 (**8095612**)
Armillaria luteobubalina Watling & Kile	MU	P	DT	KP258	8478104	-		J-2 (7681178)
Asproinocybe lyophylloides K. Syme & T. Lebel	MU	S	L	-		BP233	7611730 (ITS: MN275023, nLSU: MN275031)	
Asterostroma persimile Wakef.	RE	S	DW	-		BP040	**7679289**, 7680163, 7699379, 8565872	O-2 (**7679289**)
Athelia cf. *bombacina* (Link) Pers.	RE	S	DW	-		BP041	8630224	
Auriscalpium barbatum Maas Geest.	MU	S	L	KP393	8944903 (**ITS+nLSU: MT537113**)	-		P-1 (7700040)
Austeria citrea (Berk.) Miettinen	BR	S	DW	-		BP027	8566607	
Austropaxillus muelleri (Berk.) Bresinsky & Jarosch	MU	M	L	KP154	8691010	-		J-64 (8074348)
Banksiamyces toomansis (Berk. & Br.) G. Beaton	CD	S	DW	KP082	8565384	-		A-8 (7679009)
Basidiodendron caesiocinereum (Höhn. & Litsch.) Luck-Allen	JE	S	DW	KP367	8944334, 8944660 (**nLSU: MT524522**)	-		
Basidiodendron cinereum (Bres.) Luck-Allen	JE	S	DW	KP186	8691037	-		
Bisporella citrina (Batsch) Korf & S.E. Carp.	CD	S	L	-		BP043	7679610, 8474834, **8073236**, 8473854, 8872155	A-10 (**8073236**)

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Bolbitius titubans (Bull.) Fr. *Bolbitius titubans* var. *titubans*	MU	S	L	KP260	**7678932**, 8872538, 7597304	BP044	7659768	J-3 (**7678932**)
Bolbitius titubans (Bull.) Fr. *Bolbitus titubans* var. *olivacea*	MU	S	L	KP110	**8072523**, 8872546	-		J-70 (**8072523**)
Boletus prolinius Grgur.	MU	M	L	KP125	8477787, **8690936**	-		K-2 (**8690936**)
Boletus sinapecruentus Cleland	MU	M	L	KP055		-		
Boletus sp. A (caramel cap, non-bluing)	MU	M	L	KP126	8477833 (**ITS+nLSU: MT537040**)	-		
Boletus sp. B (red-brown pileus, faint bluing)	MU	M	L	KP120	8477744 (**ITS+nLSU: MT537038**), 8690626	BP046	7612575	
Botryobasidium aff. *conspersum* J. Erikss. (*Haplotrichum* stage)	MO	S	DW	KP389	8945098 (**nLSU: MT524523**)	-		
Botryobasidium aureum Parmasto (*Haplotrichum* stage)	MO	S	DW	KP065	8691282	BP514		
Botryobasidium sp. (grey sparse fruit body)	RE	S	DW	KP388	8945039 (**ITS+nLSU: MT537118** is from this accession, but is likely a sequence of *Meruliopsis* sp. growing adjacent to the *Botryobasidium*)	BP564	8565147	

Botryobasidium subcoronatum (Höhn. & Litsch.) Donk	RE	S	DW	KP192	8691096, 8691290, 8691347, 8872732	BP049	7678576, 8072868, 8565635, 8565562, 8871817 (**ITS: MT537015**)	O-8 (7680880)
Botryosphaeria sp. (small black blotches)	PS	S	DW	-		BP050	8475075	
Bovista pulyuggeodes Grgur.	PF	S	L	KP225	8872600	-		
Byssomerulius corium (Pers.) Parmasto	RE	S	DW	KP426		BP052	7699360, 8565279, 8565902	O-3 (7680252)
Calocera guepinioides Berk.	JE	S	DW	KP262		BP053	7589220	
Calocera sp. (longer spindles than *C. guepinioides*)	JE	S	DW	KP039	8475660	-		Q-1 (7612745)
Calvatia fusca (G. Cunn.) Grgur.	PF	S	L	KP240	8872775, 8872783	-		
Campanella gregaria Bougher (= *Resupinatus merulioides* Redhead & Ngas. ?)	SH	S	DW	KP259	8474311, 8475679, 8475407	BP054	7650256, **8095590**	0J-66 (7700113 & **8095590**)
Ceriporia aff. *spissa* (Schwein. ex Fr.) Rajchenb.	RE	S	DW	KP250	8872929 (**ITS+ nLSU: MT537083**)	-		
Ceriporia sp. (white then orange angular pores)	RE	S	DW	KP387	8474087, 8474079, 8944857 (**ITS+nLSU: MT537110**)	-		
Ceriporia tarda (Berk.) Ginns	RE	S	DW	KP072	8565244, 8478015	BP058	8477108	
Ceriporiopsis sp. (cream irregular pores)	RE	S	DW	-		BP059	8565139	
Chlorophyllum brunneum (Farl. & Burt) Vellinga	MU	S	L	KP156		-		J-41 (7680309)
Chlorophyllum molybdites (G. Mey.) Massee	MU	S	L	KP417	9178368	-		J-67 (8093474)
Chondrogaster sp. (embedded in gummy clods)	TR	M	U	-		BP061	8366683 (**ITS+ nLSU:MT537052**	

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Clathrus ruber P. Micheli ex Pers.	ST	S	DW	KP327	8566690 (**nLSU: MT524515**)	-		
Clavulina cf. *coralloides* (L.) J. Schröt.	CO	M	L	KP348	8944571 (**ITS+nLSU: MT537098**)	BP359	8475318	
Clavulina vinaceocervina (Cleland) Corner	CO	M	L	KP049	8475245	BP064	7393776, 8565538, 8871744, 8872163, 7612893, 8095671	M-3 (8073384)
Clavulina sp. (slender dusky greyish-blue branches)	CO	M	L	-		BP362	7394225	
Clitocybe brunneoceracea Cleland	MU	S	L	KP401	8945209 (**ITS+nLSU: MT537122**)	-		
Clitocybe cf. *kenkulunea* Grgur.	MU	S	DW	KP264	8565430, 8690960, 8691177, 8691185, 8872651,	BP066	8094489, 7589409, 8073260, 8073279, 7659016	J-56 (8073864)
Clitocybe semiocculta Cleland	MU	S	DW	KP263		BP067	8072469, 8871701, 7699506	J-4 (7680708)
Clitocybe sp. (tan pileus, thick rhizomorphs)	MU	S	L/DW	KP265	8475164	BP068	7659024	
Clitopilus cf. *fuligineus* (E. Horak) Noordel. & Co-David	MU	S	L	-		BP499	8095701 (**ITS: MT537010**), 8871841 (**ITS+ nLSU:MT537074**)	

Clitopilus hobsonii (Berk.) P.D.Orton	SH	S	DW	KP358	8473307, 8473420	BP075	7678746, 7678843, 8473471, 8473498, 8473587, 8630402, 8566143, 8871582	
Coltricia aff. *cinnamomea* (Jacq.) Murrill	MU	S	L	KP266		BP080	7589549, 7675615, 8944792 (host of *Hypomyces*) (**ITS+n LSU: MT537106**)	N-1 (7679815)
Colus pusillus (Berk.) Reichert	ST	S	L	-		BP081		L-1 (7680694)
Coniochaeta aff. *lignicola* (Nannf.) Z.U. Khan, Gené & Guarro	MO	S	DW	KP375	8944601 (**ITS: MT537006; nLSU: MT524541**)	-		
Coniophora olivacea (Fr.) P. Karst.	RE	S	DW	KP207	8691312 (**ITS: MT 537002; nLSU: MT524537**), 8691320	-		
Coniophora puteana (Schumach.) P. Karst.	RE	S	DW	KP412	9105042 (**ITS+nL SU: MT537126**)	BP082	8565546	
Conocybe apala (Fr.) Arnolds	MU	S	L	KP211	8872406	-		J-97 (8473501)
Coprinellus angulatus (Peck) Redhead, Vilgalys & Moncalvo	MU	S	L	-		BP084	8474826, 8475008, 8565686	
Coprinellus bipellis (Romagn.) P. Roux, Guy García & Borgarino	MU	S	L	-		BP093	764940	
Coprinellus cf. *hiascens* (Fr.) Redhead, Vilgalys & Moncalvo	MU	S	L	-		BP090	8072566	

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Coprinellus cf. *xanthothrix* (Romagn.) Vilgalys, Hopple & Jacq. Johnson	MU	S	DW	-		BP477	7699182 (**ITS+n LSU: MT537045**), 8871590 (**ITS+nLSU: MT537064**), 8871604 (**ITS+nLSU: MT537065**), 8072809	
Coprinellus disseminatus (Pers.) J.E. Lange	MU	S	DW	-		BP091	7612958	
Coprinellus flocculosus (DC.) Vilgalys, Hopple & Jacq. Johnson	MU	S	L	KP360	8944210 (**nLSU: MT554519**)	-		J-6 (7679890)
Coprinellus pyrrhanthes (Romagn.) Redhead, Vilgalys & Moncalvo	MU	S	L	KP109	8566119	-		J-69 (8072647)
Coprinellus sp. (sugar-like veil on pileus)	MU	S	L	-		BP092	7658974	
Coprinellus truncorum (Scop.) Redhead, Vilgalys & Moncalvo	MU	S	DW/L	KP152	7658451, 8478279, 8945128 (**nLSU: MT554520**)	BP099	7699190, 8094683	J-10 (7680791)
Coprinellus velatopruinatus (Bender) Redhead, Vilgalys & Moncalvo	MU	S	L	KP363	8944237 (**ITS+ nLSU: MT537093**)	-		J-7 (7680635)

Coprinopsis aff. *goudensis* (Uljé) Redhead, Vilgalys & Moncalvo	MU	S	DW	-		BP559	7676506	
Coprinopsis lagopus (Fr.) Redhead, Vilgalys & Moncalvo	MU	S	DW	KP219	8872503	-		J-8 (7680651)
Coprinopsis sp. Large, stangliana-like (N.L. Bougher NLB1424)	MU	S	L	KP267	8872767 (**ITS+ nLSU: MT537077**)	BP089	**7240694**, 7680155, 8475261 (**ITS: MT 571661; nLSU: MT554524**)	J-5 (**7240694**)
Coprinopsis sp. Peach pileus (N.L. Bougher & S. Easton	MU	S	L	-		BP088	8566712 (**ITS+** NLB911) **nLSU: MT537037**), 8871752 (**ITS+ nLSU: MT537072**)	
Coriolopsis sp. (thick dull rusty brown resupinate)	RE	S	DW	-		BP308	8477124	
Cortinarius aff. *viscoviridis* E. Horak	MU	M	L	-		BP501	7675585, 8871868 (**ITS+nLSU: MT537075**)	
Cortinarius aff. *xenosma* Soop	MU	M	L	KP153		BP536	9104593 (**ITS+ nLSU: MT537125**)	
Cortinarius archeri Berk.	MU	M	L	KP345	8630143, 8690901	-		J-34 (7699964)
Cortinarius ardesiacus Gasparini	MU	M	L	KP180	8690863 (**ITS: MT537013**)	-		
Cortinarius cf. *austroalbidus* Cleland & J.R. Harris	MU	M	L	KP233		-		
Cortinarius cf. *sublargus* Cleland	MU	M	L	-		BP102		
Cortinarius clelandii A.H. Sm.	MU	M	L	KP194	8691169	BP129	7678819, 8094438, 8475563, 8475288	

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Cortinarius microarcheri Cleland	MU	M	L	-		BP103	**8073805**	J-49 (**8073805**)
Cortinarius ochraceofulvus Cleland	MU	M	L	KP325	8630364, 8944687 **(ITS+nLSU: MT537102)**	BP104	8094446, 8475725	J-11 (7699417)
Cortinarius sp. A (dull yellow, with annulus)	MU	M	L	KP133	8478112	-		
Cortinarius sp. B (sienna pileus, white stipe)	MU	M	L	KP182	8690898	BP109	7589425, 8096155	
Cortinarius sp. C (silvery blue pileus)	MU	M	L	KP148	8478260	-		
Cortinarius sp. D (small orange-brown pileus, short white stipe)	MU	M	L	KP235	8872686	-		
Crepidotus eucalyptorum Cleland	SH	S	B	KP268	8476810	BP113	7612966, 7650396, 8630216, 8871779, 8871639	J-13 (7680821)
Crepidotus nephrodes (Berk. & M.A.Curtis) Sacc.	SH	S	DW	KP269	7612699, 8565198, 8478147	BP115	7589115, 7679076, 7679181	
Crepidotus prostratus Cleland	MU	S	L/DW	KP314		BP116	8473544	J-35 (7699816)
Crepidotus sp. A (white circular fruit bodies)	SH	S	DW	-		BP120	8095752	
Crepidotus sp. B (pale smooth pileus)	SH	S	DW	-		BP121	8073201	

Crepidotus sp. C (small white fruit bodies)	SH	S	DW	KP316	8476748, 8473404	BP122	8072485, 7675682	
Crinipellis sp. (tiny cushion-like fruit bodies)	MU	S	DW	KP084	8565570	-		
Crustoderma cf. *marianum* Nakasone	RE	S	DW	KP205	8691274 (This *Crustoderma* is parasite of *Hydnoplicata* sp.) **(ITS+nLSU: MT537060)**, 8691339 **(ITS: MT 537003; nLSU: MT524538)**	-		
Cudoniella sp. (greenish fruit bodies)	CD	S	L	KP046		-		
Cyathus olla (Batsch) Pers.	BN	S	DW	KP242		BP123		L-7 (7699824)
Cyathus stercoreus (Schwein.) De Toni	BN	S	DW	KP218	8872481	-		L-8 (7597347)
Cyathus striatus (Huds.) Willd.	BN	S	DW	KP222	8872570	-		
Dacrymyces stillatus Nees	JE	S	DW	KP098	8566089	BP125		
Dendrominia sp. Large white patch on tuart (N.L. Bougher NLB1479)	RE	S	DW	-		BP517	8872317 **(ITS+nLSU: MT537091)**, 8872341	
Dendrothele incrustans (P.A. Lemke) P.A. Lemke	RE	S	DW	KP398	8945144	-		
Dendrothele sp. Small white patches on tuart (N.L. Bougher NLB1478)	RE	S	DW	-		BP524	8872309 **(ITS+ nLSU: MT537090)**, 8872325, 8872333 **(ITS: MT537023)**, 8872368 **(ITS: MT537024)**, 9178538 **(ITS+ nLSU: MT537130)**	

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Dentipellis sp. (delicate, dendritic resupinate)	RE	S	DW	-		BP128	7699484	
Descolea maculata Bougher	MU	M	L	KP272	8565589	BP130	7679300	J-33 (7699859)
Descolea sp. Broad-spored (N.L. Bougher & K.J. Tullis NLB1038)	TR	M	U	KP139	8478198	-		
Dichostereum pallescens (Schwein.) Boidin & Lanq.	RE	S	DW	KP074	8565201	-		
Dichostereum rhodosporum (Wakef.) Boidin & Lanq.	RE	S	DW	KP238	8872805	BP516	7675674, 8872260	
Eichleriella aff. *leucophaea* Bres.	JE	S	DW	KP246	8872937 (**ITS+ nLSU: MT537084**)	-		
Eichleriella sp. Yellow scabs (N.L. Bougher E9320)	JE	S	DW	KP015	8474109 (**ITS: MT536990; nLSU: MT524525**)	BP147		
Entoloma aff. *sericeum* Quél.	MU	S	L	-		BP136	7588941, 7699328	
Entoloma sp. (brown rimose pileus)	MU	S	L	-		BP139	8072558, 8072671	
Entoloma viridomarginatum (Cleland) E. Horak	MU	S	L	-		BP143	**8073708**	J-43 (**8073708**)
Exidia sp. (bluish-tinged fruit bodies)	JE	S	DW	KP004		BP145	8474796	
Exidiopsis sp. A (grey fruit bodies)	JE	S	DW	KP195	8691215	BP380	7679688	

Exidiopsis sp. B (grey-pinkish fruit bodies)	JE	S	DW	-		BP146	8476659	
Fistulina hepatica (Schaeff.) With.	BR	S	DW	KP377		-		N-9 (7680945)
Fomitiporia aff. *australiensis* M. Fisch., Jacq. Edwards, Cunningt. & Pascoe	BR	S	DW	KP239	8872848 (**ITS+ nLSU: MT537079**)	-		
Fomitiporia robusta (P.Karst.) Fiasson & Niemelä	BR	P	DT	KP297		BP316	7611994	N-6 (7650000)
Fuscoporia aff. *viticola* (Schwein.) Murrill	RE	S	DW	KP174	8690855 (**ITS: MT536994; nLSU: MT524529**)	BP498	8871949	
Fuscoporia cf. *gilva* (Schwein.) T.Wagner & M.Fisch.	BR	S	DW	KP083		-		
Galerina cf. *bullulifera* Singer	MU	S	DW	KP042	8475415	-		
Galerina marginata (Batsch) Kühner	MU	S	DW	KP096	8872740	BP151	8475024, 8565511, 8871760,	
Galerina sp. A (bright pileus & gills)	MU	M	L	-		BP219	7679165 (**ITS: MT537008**)	
Galerina sp. B (greasy hemispherical pileus)	MU	M	DW	-		BP562	8871981	
Galerina unicolor (Vahl) Singer	MU	S	MG	-		BP161	7612788, 7589174	
Ganoderma australe (Fr.) Pat.	BR	P	DW	KP163	8690723, 8944881 (**ITS+nLSU: MT537112**)	-		
Geastrum aff. *pectinatum* Pers.	ES	S	L	-		BP162	8630208, 8630240	
Geastrum australe Berk.	ES	S	L	KP169		-		
Geastrum elliptice G. Cunn.	ES	S	L	-		BP471	8871493	
Geastrum triplex Jungh.	ES	S	L	KP221	8935149	-		L-11 (8073090)

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Gerronema sp. (slender fruit bodies in clumps)	MU	S	DW	-		BP467	7589336 **(ITS+nLSU: MT537041)**, 7699204 **(ITS+nLSU: MT537044)**	
Gloeocystidiellum sp. (smooth, white resupinate)	RE	S	DW	KP135	8478236	-		
Gloeoporus dichrous (Fr.) Bres.	BR	S	DW	KP209	8691207 **(ITS: MT537000; nLSU: MT524535)**	-		
Gloiothele globosa Sheng H. Wu	RE	S	DW	KP168	8690790 **(ITS: MT536993; nLSU: MT524528)**	-		
Glonium circumserpens (Nyl.) Kantvilas & Coppins	PS	S	DW	-		BP528		
Grandinia sp. (grey waxy resupinate)	RE	S	DW	KP147		BP164	7678517	
Gymnogaster boletoides J.W. Cribb	TR	M	U	-		BP165	8473455	
Gymnopilus allantopus (Berk.) Pegler	MU	S	DW	KP277	8474281	BP167	7589506, **7612761**	J-15 (7680082 & **7612761**)
Gymnopilus crociphyllus (Sacc.) Pegler	MU	S	DW	KP197	8691142 **(ITS: MT536998; nLSU: MT524533)**	-		

Gymnopilus junonius (Fr.) P.D. Orton	MU	S	DW	KP237	8872856	-		J-101 (no voucher)
Gymnopilus perplexus B.J.Rees	MU	S	DW	KP278	8565406	BP169	7589417	
Gymnopilus purpuratus (Cooke & Massee) Singer	MU	S	DW	KP279		BP168	7589328	
Gymnopilus sp. (large fruit bodies on pine wood)	MU	S	DW	-		BP170	8475695	
Gymnopus villosipes (Cleland) Desjardin	MU	S	DW/ L & B	-		BP077	7701411, 8566674, 8871523 (**ITS+nLSU: MT537062**), 8872252 (**ITS+nLSU: MT537088**)	
Gyrodontium sacchari (Spreng.) Hjortstam	RE	S	DT/B	-		BP173	**8072841**	O-9 (**8072841**)
Gyroporus occidentalis Davoodian, Bougher & Halling	MU	S	L	KP411	7572646	BP174	8072515	K-3 (7680538)
Harknessia uromycoides (Speg.) Speg.	PS	S	DW	KP281		BP175	8094519, 8475113, **7678827**	C-1 (**7678827**)
Hebeloma cavipes Huijsman	MU	M	L	-		BP176	7696906 (**ITS+nLSU: MT 571658**), **8073155**, 8095809	J-73 (**8073155**)
Hebeloma crustuliniforme (Bull.) Quél.	MU	M	L	KP422	9178570 (**ITS+ nLSU: MT537131**)	-		
Hemimycena cephalotricha (Joss. ex Redhead) Singer	MU	S	DW	-		BP177	8473595	
Hemimycena cf. *lactea* (Pers.) Singer	MU	S	L	KP021	8474133, 8566534	BP289	7588909, 8094748, 8094616	

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Hemimycena hirsuta (Tode) Singer	MU	S	DW	-		BP178	8095620, 8565996	
Hemimycena sp. (minute, white fruit bodies, arcuate lamellae)	MU	S	L	KP006	8473412, 8473439	BP179	7680147, 8473668	
Henningsomyces candidus (Pers.) Kuntze	CY	S	DW	KP282	8476802	BP180	7675577, **7679629,** 8474885	R-1 (**7679629**)
Heterorepetobasidium sp. (pinkish brown)	JE	S	DW	KP403	8945217 (**nLSU: MT524524**)	-		
Hexagonia vesparia (Berk.) Ryvarden	BR	S	B	KP283	7658923	BP181	7658982, **7673817,** 8871655	N-3 (**7673817**)
Hohenbuehelia bingarra Grgur.	SH	S	DW	KP352		BP183	7611846, 7680260, 8092753, **8072787,** 8473382, 8566399, 8872007, 8872015	J-74 (**8072787**)
Hohenbuehelia clelandii Grgur.	SH	S	L	-		BP184	7589026	
Hohenbuehelia petaloides (Bull.) Schulzer	SH	S	DW	KP234	8873178	-		
Hohenbuehelia sp. Hairy (N.L. Bougher & P. Robertson BOUGHER514)	MU	S	DW	KP001	8473293	-		
Hyalopeziza sp. (thick-walled brown hairs)	CD	S	L	-		BP513	8872139	
Hyaloscypha cf. *carnosa* (Rodway) Spooner	CD	S	DW	-		BP126	8477094, 8474915	

Hyaloscypha hyalina (Pers.) Boud.	CD	S	DW	-		BP186	8475741	
Hyaloscypha sp. (minute discs on zamia fronds)	CD	S	DW	-		BP187	8095760, 8475776	
Hydnangium carneum Wallr.	TR	M	U	KP410	9105093	BP188	**7699158**	I-2 (**7699158**)
Hydnomerulius pinastri (Fr.) Jarosch & Besl	RE	S	DW	KP201	8691266 (**ITS: MT537017**)	-		
Hydnoplicata convoluta (McAlpine) Trappe & Claridge	TR	M	U	-		BP189	7648472, **7678703**, 7699174, 8475083	E-1 (**7678703**)
Hydnoplicata sp. (parasitised by *Crustoderma*)	TR	M	U	KP202	8691274	-		
Hydropus sp. Blue-green pileus (N.L. Bougher & P. Wilshaw NLB1550)	MU	S	L	KP390	8944911 (**ITS+nLSU: MT571660**)	-		
Hygrocybe sp. (orange pileus yellow stipe)	MU	S	L	-		BP191	7675593, 8096147 (**ITS+nLSU: MT537048**), 8095604 (**ITS+nLSU: MT537049**)	
Hymenoscyphus sp. A (cream funnels)	CD	S	L	-		BP192	8475377, 8566615	
Hymenoscyphus sp. B (cushion-dome shaped)	CD	S	DW	KP028	8476780, 8476756, 8565473	-		
Hymenoscyphus sp. C (orange then greenish)	CD	S	DW	KP185	8566100, 8690995	-		
Hymenoscyphus sp. D (long white stalk)	CD	S	DW	KP244	8872880	-		
Hyphoderma assimile (H.S. Jacks. & Dearden) Donk	RE	S	DW	-		BP193	8475016	

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Hyphoderma cf. *setigerum* (Fr.) Donk	RE	S	DW	-		BP558	8565287	
Hyphoderma sp. (felty grey resupinate)	RE	S	DW	KP420	8944865 **(ITS: MT537030)**	-		
Hyphodontia aff. *crustosa* (Pers.) J. Erikss.	RE	S	DW	KP248	8872945, 8944636 **(ITS+nLSU: MT537100)**	-		
Hyphodontia arguta (Fr.) J. Erikss.	RE	S	DW	KP356		BP195	**7699336**	O-7 (**7699336**)
Hyphodontia sp. A (white resupinate with spiky warts)	RE	S	DW	-		BP198	8565759	
Hyphodontia sp. B (white resupinate with low warts)	RE	S	DW	KP286	8872910	BP525	8565120	
? *Hypochniciellum* sp. (soft, easily removed resupinate) [DNA sequence places this in Stephanosporaceae, and therefore it may not belong in *Hypochniciellum* (Amylocorticiales)]	RE	S	DW	-		BP519	8872244 (**ITS+ nLSU: MT537087**)	
Hypochnicium cf. *michelii* Tellería, M. Dueñas, Melo & M.P. Martín	RE	S	DW	-		BP194	7673833	
Hypomyces chrysospermus Tul. & C. Tul.	MO	S		KP405		BP047		

Hypomyces dactylarioides G.R.W. Arnold	MO	S	DW	KP404	8944490 **(ITS: MT537005; nLSU: MT524540)**	BP199	7699387	
Hypomyces sp. (parasitising *Coltricia*)	MO	S	DW	KP385	8944792 (**ITS+ nLSU: MT537107**)	-		
Hypoxylon diatrypeoides Rehm	FL	S	DW	-		BP204	8072833, 8473560, 8476705, 8872120	
Hysterangium sp. (white unchanging fruit bodies)	TR	M	U	KP138	8478171	BP207	8476713	
Ileodictyon gracile (truffle form)	TR	M	U	KP104	8566232 (**nLSU: MT524514**)	BP344	7626665, 8871884 **(nLSU: MT524520)**	I-12 (7648065)
Inocybe clypeata Matheny & Bougher	MU	M	L	-		BP212	8320276, 8320268 (ITS: KF871781, nLSU: KF853405, RPB2: KF891958)	
Inocybe emergens (Cleland) Grgur.	MU	M	L	KP251	8872996 **(ITS+nLSU: MT537086)**	-		
Inocybe fissurata Matheny & Bougher	MU	M	L	KP177	8690812, 8872430, 8872864	-		
Inocybe froudistii Matheny & Bougher	MU	M	L	KP144	8383391, 8383405 (ITS: KJ778859, nL SU: KJ801170, RPB2:	BP209	7589069 (ITS: KJ756432) KC305461), 7678096, 7678088, 8320241, 8320314	
Inocybe leucotaenia Matheny & Bougher	MU	M	L	-		BP211	8072477 (ITS: KF871785, nLSU: KF853409, RPB2: KF891962), 8073171 (ITS: KF871783, nLSU: KF853407, RPB2: KF891960), 8320306	

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Inocybe rufuloides Matheny & Bougher	MU	M	L	KP402	8945179	BP208	8073147, 8305951, 8305978, 8320233, 8872023	
Inocybe sp. AU92 false murrayana (N.L. Bougher NLB1121)	MU	M	L	KP178	8690820 (**ITS+nLSU: MT537058**), 8945187 (**ITS+nLSU: MT537120**), 9104577 (**ITS+nLSU: MT537123**)	BP530	8871698 (**ITS+nSU: MT537070**)	
Inocybe sp. AU92 small spores (N.L. Bougher NLB1146)	MU	M	L	KP193	8691118	-		
Inocybe subferruginea Matheny & Bougher	MU	M	L	-		BP213	7589255	
Inocybe violaceocaulis Matheny & Bougher	MU	M	L	KP176		BP220	7699514	J-16 (7678738)
Junghuhnia sp. (cream pored resupinate with orange stains)	RE	S	DW	-		BP221	8475040, 8565775	
Kurtia argillacea (Bres.) Karasinski	RE	S	DW	KP243	8872902	BP495	8871914	
Laccaria lateritia Malençon	MU	M	L	KP287	8475156, 8873038	BP223	7612826, 8094691	J-17 (7658583)
Laccaria sp. (orange-brown pileus, pale lamellae)	MU	M	L	KP288		BP222	7612923, 8094500 (**ITS+nLSU: MT537047**), 8475539 (**ITS+nLSU: MT537054**), 8474850	

Lachnum sp. (minute fruit bodies like feather dusters)	CD	S	DW	KP047	8473447, 8475466	-		
Lachnum virgineum (Batsch) P. Karst.	CD	S	DW	KP077	8478201	BP500		A-6 (8073848)
Laetiporus portentosus (Berk.) Rajchenb.	BR	P	DT	KP289		BP225	7588895	
Lanzia cf. *prasina* (Massee) Spooner	CD	S	DW	KP245	8872872	-		
Lanzia sp. (funnel-shaped fruit bodies with scurfy base)	CD	S	DW	KP012	8473358, 8565465	BP227	7679343, 8477078, 8475717, 8565929, 8566216,	
Lasiosphaeria ovina (Pers.) Ces. & De Not.	PS	S	DW	KP371	8944423	BP228	**7699298**	A-2 (**7699298**)
Lentinellus pulvinulus (Berk.) Pegler	SH	S	B	-		BP229	7659865, 8072779, 8871647	J-77 (8072779)
Lentinellus tasmanicus R.H. Petersen	MU	S	L	-		BP069	7679203 **(ITS+nLSU: M 537042)**, 8475814 **(ITS+nLSU: MT537053)**	
Lepiota booloola Grgur.	MU	S	L	KP227	8872716, 8872724, 8944938 **(ITS: MT571656)**	-		
Lepiota discolorata Cleland	MU	S	L	-		BP231	7699301	
Lepiota exocarpi Cleland	MU	S	L	KP394	8944946 **(ITS+ nLSU: MT571655)**	BP232	**7699492**, 8094497	J-93 (**7699492**)
Lepiota sp. A (large, scaly pileus, short stipe)	MU	S	L	-		BP241	8475032	
Lepiota sp. B (minute white fruit bodes with white annulus)	MU	S	L	KP198	8691150	-		

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Leucoagaricus americanus (Peck) Vellinga	MU	S	L	KP416	9178392	-		
Leucoagaricus meleagris (Gray) Singer	MU	S	DW	-		BP235	**7679777**	J-42 (**7679777**)
Leucoagaricus subcretaceus Bon	MU	S	L	-		BP234	8072507 (**ITS+nLSU: MT537034**)	
Leucocalocybe sp. (weedy, lepista-like)	MU	S	L	KP400	8945195	BP481	7588976, 7589018, 7681267 (**ITS+nLSU: MT537043**), 8094462 (**ITS+nLSU: MT537046**), 8871663, 8872058 (**ITS+nLSU: MT537081**), 8945195 (**ITS+nLSU: MT537121**)	J-40 (7681038)
Leucocoprinus aff. *badhamii* (Berk. & Broome) Locq.	MU	S	L	-		BP505	8871973 (**ITS+nLSU: MT537080**)	
Leucocoprinus cretaceus (Bull.) Locq.	MU	S	L	KP415	9178333	-		
Leucogyrophana pseudomollusca (Parmasto) Parmasto	RE	S	DW	KP200	8691231, 8691258 (**ITS: MT537016**)	-		

Lichenomphalia umbellifera (L.) Redhead, Lutzoni, Moncalvo & Vilgalys	MU	S	L	KP342	8566038	BP296		
Limacella pitereka Grgur.	MU	S	L	KP290	8474346, 8478031, 8691134	BP237	7589298	J-79 (8096627)
Lindtneria chordulata (D.P. Rogers) Hjortstam	RE	S	DW	KP191	8691088 **(ITS: MT537014)**	BP507	8872074 **(ITS+ nLSU: MT537082)**, 8872082 **(ITS: MT537019)**	
Litschauerella gladiola (G. Cunn.) Stalpers & P.K. Buchanan	RE	S	DW	-		BP504	8871833	
Lycoperdon cf. *hiemale* Bull.	PF	S	L	KP123	8478139	-		
Lycoperdon cf. *perlatum* Pers.	PF	S	L	KP241		-		
Lycoperdon pratense Pers.	PF	S	DW	-		BP465		
Lyophyllum aff. *anthracophilum* (Lasch) M. Lange & Sivertsen	MU	S	L	KP117	8566682 **(ITS+ nLSU: MT537036)**	-		
Lysurus mokusin (L.) Fr.	ST	S	L	KP094	8477213	-		
Macrohyporia dictyopora (Cooke) I. Johans. & Ryvarden	RE	S	DW	KP069	8630380, 8872643 **(ITS+nLSU: MT537069)**	BP240	7680171, 8565856	
Macrolepiota vinaceofibrillosa T. Lebel	PF	S	L	-		BP134	8473641	
Mallocybe isabellina (Matheny & Bougher) Matheny & Esteve-Rav.	MU	M	L	KP118	8309078	-		
Mallocybe sabulosa (Matheny & Bougher) Matheny & Esteve-Rav.	MU	M	L	-		BP214	8320292 (ITS: KP308825, nLSU: KP170997, RPB2: KM406237), 8871558	

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Marasmius sp. (horsehair-like, not *M. crinis-equi*)	MU	S	L	-		BP246	7611900, 7675658, 7679335	
Martininia panamaensis Dumont & Korf	CD	S	DW	-		BP248	8475350 (**ITS: MT536991; nLSU: MT524526**)	
Melampsora euphorbiae (Ficinus & C. Schub.) Castagne	RU	P	DT	-		BP563		
Melanoleuca cf. *fusca* (Cleland) Grgur.	MU	S	L	KP228	8872708	-		
Melanoleuca excissa (Fr.) Singer	MU	S	L	KP396	8945071 (**ITS+nLSU: MT537119**)	-		
Melanoleuca fusca (Cleland) Grgur.	MU	S	L	KP203	8691363 (**ITS+nLSU: MT537061**)	BP487	7589492, 7673787	J-19 (7681119)
Melanoleuca tristis M.M. Moser	MU	S	L	KP429	8944563 (**ITS+nLSU: MT571653**)	-		
Merismodes anomala (Pers.) Singer	CY	S	DW	KP048	8475172	BP224	**7679696**	R-4 (**7679696**)

Meruliopsis sp. (resupinate, curtain-like surface)	RE	S	DW	KP165	8690804 **(ITS: MT537012)**, 8691193 **(ITS: MT536999; nLSU: MT524534)**, 8944830 **(ITS+nLSU: MT537109)**, 8944598 **(ITS+nLSU: MT537099)**, see also note on 8945039 under *Botryobasidium* sp. (grey sparse fruit body)	-		
Mollisia cinerea (Batsch) P. Karst.	CD	S	DW	-		BP250	8566178, 8630232, 8565724, 8475253	
Mollisia sp. (tiny bluish flat discs)	CD	S	DW	KP247	8872988, 8944784 **(ITS+nLSU: MT537105)**	-		
Mycena carmeliana Grgur.	MU	S	DW	KP136	8478155	-		
Mycena fumosa Grgur.	MU	S	DW	-		BP253	8566623	
Mycena judithiana Bougher	MU	S	DW	-		BP254	8023093	
Mycena kuurkacea Grgur.	MU	S	L	KP293	8566011	BP255	**8073791**, 7589158, 7675607, 7679173, 8095655	J-82 (**8073791**)
Mycena nargan Grgur.	MU	S	DW	KP292	7678916, 8473366, 8478082, 8478023	BP256	7679068	J-20 (7678916)
Mycena sp. A (bluish viscid fruit bodies)	MU	S	L	KP128	8477809	-		
Mycena sp. B (small fruit bodies on moss)	MU	S	MB	KP041		BP262	7612974, 8092729	

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Mycena sp. C (dark brown/ black fruit bodies in litter)	MU	S	L	KP005		BP276	7589360, 8094527	
Mycena sp. D (grey pileus, in pine litter)	MU	S	L	-		BP286	7588992	
Mycena sp. E (minute white fruit bodies deep in litter)	MU	S	L	KP143		-		
Mycena sp. F (minute semi-translucent fruit bodies lacking lamellae)	MU	S	DW	KP171		-		
Mycena sp. G (fruit bodies with pubescent yellow stipe, on wood)	MU	S	DW	-		BP275	8565910	
Mycena sp. H (slender, cream fruit bodies in litter)	MU	S	L	-		BP272	7589301, 8094667, 8073252	
Mycena subgalericulata Cleland	MU	S	DW	KP188		BP292	7612834, 7589263, 7681097, **8073368**	J-47 (**8073368**)
Mycena tenerrima (Berk.) Quél.	MU	S	L	KP129		BP293	8475148, 8566135	J-81 (8023115)
Mycenastrum corium (Guers.) Desv.	PF	S	L	KP365	8944318	-		L-2 (8096651)
Mycocalicium subtile (Pers.) Szatala	FL	S	DW	-		BP518	8872198 **(ITS: MT537004; nLSU: MT524539)**	

Nemania sp. (multiple small black cushions)	FL	S	DW	-		BP206	8872201 **(ITS: MT537021)**	
Nodulisporium sp. (rusty powery growth on wood)	MO	S	DW	KP116		BP295	8476675	
Odonticium septocystidia (Burt) Zmitr. & Spirin	RE	S	DW	KP373	8944504 (**ITS: MT537026**), 8945020 (**ITS+nLSU: MT537117**)	-		
Omphalotus nidiformis (Berk.) O.K.Mill.	SH	S/P	DW/B	KP296	8475482, 8690758	BP297	**7589344**, 7589522	J-21 (**7589344**)
Orbilia aff. *epipora* (Nyl.) P. Karst.	CD	S	L	KP378	8944768 (**ITS: MT537007; nLSU: MT524542**)	BP298	8072795	
Orbilia aff. *xanthostigma* (Fr.) Fr.	CD	S	L	KP391	8945101	-		
Panaeolina foenisecii (Pers.) Maire	MU	S	L	KP214	8872422, 8872589	-		
Panaeolus papilionaceus (Bull.) Quél.	MU	S	L	KP364	8944261, 8944954 **(ITS+nLSU: MT571659)**	BP299	7589514	J-83 (8072949)
Panellus stipticus (Bull.) P. Karst.	SH	S	B	-		BP230	7659776, 7659792, 7659008	
Panus fasciatus (Berk.) Pegler	MU	S	DW	KP333		BP303	**7670710**, 7679327	J-24 (**7670710**)
Parasola auricoma (Pat.) Redhead, Vilgalys & Hopple	MU	S	DW	KP108	8566275	-		
Parasola conopilea (Fr.) Örstadius & E. Larss.	MU	S	DW	KP124	8477825	BP354		
Parasola hercules (Uljé & Bas) Redhead, Vilgalys & Hopple	MU	S	DW	KP361	8944229 **(ITS+nLSU: MT537092)**	BP476	8871574 **(ITS+nLSU: MT537063)**	

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Parasola plicatilis (Curtis) Redhead, Vilgalys & Hopple	MU	S	L	-		BP085		J-9 (7680325)
Peniophora scintillans G. Cunn.	RE	S	DW	KP093	8565619	BP512	8872112	
Peniophora cinerea (Pers.) Cooke	RE	S	DW	KP155	8944822	BP304	8475091, 8072493, 8565716, 8565864, 8566410	
Peniophora sp. A (grey felty resupinate)	RE	S	DW	-		BP306	8095787	
Peniophora sp. B (grey smooth, thin resupinate)	RE	S	DW	-		BP307	8475520	
Perenniporia cf. *oviformis* G.Cunn. ex P.K. Buchanan & Ryvarden	RE	S	DW	KP299	8475237, 7608764 **(ITS+nLSU: MT571669)**	-		
Perenniporia ochroleuca (Berk.) Ryvarden	BR	S	DT	KP172	8566070	BP483		
Peziza austrogeaster (Rodway) Rifai	CD	S	L	-		BP309	7659849	
Peziza cf. *retispora* Rifai	CD	S	L	-		BP311	7678665	
Peziza cf. *thozetii* Berk.	CD	S	DW	-		BP510	8872066	
Peziza moravecii (Svrcek) Donadini	CD	S	L	KP018	8474117	-		
Peziza repanda Wahlenb.	CD	S	L	KP206	8691371, 8872511	-		

Peziza tenacella W. Phillips	CD	S	BG	KP051	8473811	-		
Phaeotrametes decipiens (Berk.) Lloyd ex J.E.Wright	BR	S	DT	KP326	8566054	-		N-5 (7678045)
Phanerochaete aculeata Hallenb.	RE	S	DW	KP423	8566348	BP197	8475768	
Phanerochaete luteoaurantiaca (Wakef.) Burds.	RE	S	DW	KP223	8872619 **(ITS+nLSU: MT537067)**	-		
Phanerochaete sordida (P. Karst.) J. Erikss. & Ryvarden	RE	S	DW	KP224	8872627 **(ITS+nLSU: MT537068)**	BP305	7681070, 8565945	
Phanerochaete sp. A (pale yellow to ochre patchy resupinate)	RE	S	DW	-		BP313	8566186	
Phanerochaete sp. B (cream resupinate with dentate & sharp pegs)	RE	S	DW	-		BP560	8872279 **(ITS+nLSU: MT537089)**	
Phanerochaete sp. C (khaki waxy resupinate with rounded warts)	RE	S	DW	KP370	8944415 **(ITS+nLSU: MT537095)**	BP463	8565953	
Phanerochaete tuberculata (P. Karst.) Parmasto	RE	S	DW	-		BP314	8630410	
Phlebia subochracea (Alb. & Schwein.) J. Erikss. & Ryvarden	RE	S	DW	KP141	8478287	-		
Phlebia cf. *cornea* (Bourdot & Galzin) Parmasto	RE	S	B	-		BP318	7699115	
Phlebia rufa (Pers.) M.P. Christ.	RE	S	B	KP425	8473269	BP319	**7678681**, 8565708, 8566208	O-5 (**7678681**)
Phlebia subceracea (Wakef.) Nakasone	RE	S	DW	KP294	8565392	BP321	7678533, 8477043, 8473528	O-4 (7678894)

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Phlebiopsis crassa (Lév.) Floudas & Hibbett	RE	S	DW	KP343	8473390	BP182	**8094470**, 8476691, 8871566, 8872287	O-10 (**8094470**)
Pholiota aff. *decussata* (Fr.) M.M. Moser	MU	S	L	-		BP537	9104585 **(ITS+nLSU: MT537124)**	
Pholiota communis (Cleland & Cheel) Grgur.	MU	S	DW	KP301	8691371	BP322	8095582	J-26 (7681127)
Pholiota highlandensis (Peck) Quadr.	MU	S	BG	KP078	8565171	-		
Phomopsis leptostromiformis (J.G. Kühn) Bubák	PS	P	DW	-		BP076	8473838	
Phyllachora amplexicaulis C.A. Pearce, Reddell & K.D. Hyde	PS	P	DT	-		BP323	8072752	C-2 (**8072752**)
Phylloporus clelandii Watling	MU	M	L	KP053	813095, 770973, 7586671, 8072612 **(ITS+nLSU: MT537132)**, 8565163 **(ITS+nLSU: MT537133)**	-		K-5 (8072582)
Picipes aff. *badius* (Pers.) Zmitr. & Kovalenko	BR	S	B	KP305		BP397	7612818, 7659784, 7589441, 7589573, 7679319, 8073732 **(ITS+nLSU: MT571670)** **8073783**	N-12 (**8073783**)

Piloderma sp. A (bright orange & white resupinate)	RE	S	DW	KP421	8690847 **(nLSU: MT524518)**	-		
Piloderma sp. B (dull yellow resupinate)	RE	S	DW	KP170	8690839 **(nLSU: MT524517)**	BP561	8565503	
Piloderma sp. C (snowy white resupinate)	RE	S	L	KP142	8478309, 8690677 **(nLSU: MT524516)**, 8690685, 8691002 **(ITS: MT536996; nLSU: MT524531)**, 8872813 **(ITS+nLSU: MT537078)**, 8872961 **(ITS+nLSU: MT537085)**, 8944652	BP327	7678169, 8475806	
Piptoporus australiensis (Wakef.) G.Cunn.	BR	S	DT	KP302		BP328	**7612621**, 8871477	N-7 **(7612621)**
Pisolithus albus (Cooke & Massee) Priest	PF	M	L	-		BP329	**7394683**	L-3 **(7394683)**
Pisolithus marmoratus (Berk.) E. Fisch.	PF	M	L	KP159	8477817 **(ITS+nLSU: MT537039)**, 8690634, 8872562 **(ITS+nLSU: MT537066)**	BP330	7394691, 7394675	
Plectania sp. (stalked black saucers)	CD	S	L	-		BP333		
Pleuroflammula praestans E. Horak	SH	S	DW	KP029	8476853	BP334	7611854, 8475059, 8565252	J-48 (8073821)
Plicaria cf. *alveolata* (Rodway) Rifai	CD	S	L	-		BP336	8073740, 8871892	
Plicaria cf. *endocarpoides* (Berk.) Rifai	CD	S	L	-		BP337	8477221	

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Plicaria sp. (long stipe)	CD	S	L	-		BP338	8566720	
Pluteus cervinus (Schaeff.) P. Kumm.	MU	S	DW	KP167	8690774	-		
Pluteus pauperculus E. Horak	MU	S	DW	KP355	8474338, 8565597	BP339	7589107, 8094705	J-44 (7680953)
Pluteus perroseus E. Horak	MU	S	DW	KP066	8495580	-		
Pluteus petasatus (Fr.) Gillet	MU	S	L/DW	KP060	8630186	-		J-65 (8073694)
Pluteus romellii (Britzelm.) Sacc.	MU	S	DW	KP395	8944962 **(ITS+nLSU: MT537114)**	-		
Pluteus sp. (small fruit bodies in woodchips)	MU	S	DW	KP418	9178384	-		
Pogisperma (informal name) sp. Orange gleba (S.Q. Bolsenbroek H7544)	TR	M	U	-		BP410	7626673	
Porpoloma sp. Olive-red pileus (N.L. Bougher & M.J. Bougher	MU	M	L	-		BP539	8478414 NLB1062) **(ITS+nLSU: MT537057)**	
Postia aff. *pelliculosa* (Berk.) Rajchenb.	BR	S	DW	KP100	8690987 **(ITS: MT536995; nLSU: MT524530)**, 8944482 **(ITS: MT537025)**	-		
Propolis farinosa (Pers.) Fr.	PS	S	DW	KP033	8475598	BP343	7679661	
Psathyrella bipellis (Quél.) A.H. Sm.	MU	S	L	KP213	8872449	-		J-98 (8072590)

Psathyrella candolleana (Fr.) Maire	MU	S	DW	KP217	8872473	BP345	7612915, 7679041, 8871515
Psathyrella cf. *albidula* Romagn.	MU	S	L	KP212	8872414	-	
Psathyrella cf. *tephrophylla* (Romagn.) Bon	MU	S	L	KP215	8872457	BP353	7678568
Psathyrella sp. A (with pale-spores)	MU	S	DW	KP419	9178376	-	
Psathyrella sp. B (on burnt wood, with white patches on pileus)	MU	S	DW	KP068	8630356	-	
Pseudotomentella larsenii Kõljalg & Dunstan	RE	S	DW	KP382	8944733 (**ITS+ nLSU: MT537103**), 8944849 (**ITS: MT537029**), 8945047 (**ITS: MT537032**)	BP025	8565554
Psilocybe coprophila (Bull.) P. Kumm.	MU	S	D	-		BP355	J-95 (8095566)
Puccinia myrsiphilli (Thüm.) G. Winter	RU	P	DT	KP351		BP356	**8092788** R-5 (**8092788**)
Pulvinula archeri (Berk.) Rifai	CD	S	BG	KP052	8473943	-	A-3 (7699352)
Pulvinula sp. (orange cups)	CD	S	L	-		BP452	8566488
Punctularia strigosozonata (Schwein.) P.H.B. Talbot	BR	S	DW	KP162	8690693, 8690979	BP503	8871965
Purpureocorticium sp. Cream (N.L. Bougher NLB 1531)	RE	S	DW	KP432	8944709 (**ITS: MT537028**)		
Purpureocorticium sp. Dried Mustard (N.L. Bougher & Y. Broome NLB 1389)	RE	S	DW	KP368		BP484	8871736 (**ITS+nLSU: MT537071**)
Pyronema omphalodes (Bull.) Fuckel	CD	S	BG	KP157	8670315	BP472	8871507

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Radulomyces sp. (grey waxy resuspinate)	RE	S	DW	KP409	8944873 **(ITS+nLSU: MT537111)**	-		
Ramaria cf. *gracilis* (Pers.) Quél.	CO	M	L	KP308		BP360	7393849, **7393806**, 7393768, 7393725	M-1 (**7393806**)
Ramaria sp. A (pale, thick-wrinkly branched fruit bodies)	CO	M	L	KP359		BP527	7393822, 7393814, 7393733	
Ramaria sp. B (pale, stocky fruit bodies)	CO	M	L	-		BP364	8092745	
Ramaria sp. C (white, richly branched fruit bodies)	CO	M	L	KP037	8566240	BP361		
Rectipilus sp. (tiny pale cups on wood)	CY	S	DW	-		BP367	8092443	
Reddellomyces westraliensis (G.W. Beaton & Malajczuk) Trappe, Castellano & Malajczuk	TR	M	U	KP332	8473617	-		
Resinicium meridionale (Burds. & Nakasone) Nakasone	RE	S	DW	-		BP494	8871906 **(ITS+nLSU: MT537076)**	
Resupinatus subapplicatus (Cleland) Grgur.	SH	S	DW	KP254	8476632, 8475474	BP391	**8073341**, 8095698, 8095779	J-51 (**8073341**)
Rhizochaete aff. *radicata* (Henn.) Gresl., Nakasone & Rajchenb.	RE	S	DW	KP366	8944342 **(ITS+nLSU: MT537094)**	-		

Rhizocybe sp. Cinnamon pileus (N.L. Bougher, *et al.* E9044)	MU	S	L	-	'8094454 **(ITS+nLSU: MT571663)**	BP070	8094454	
Rhizopogon lutescens A.H. Sm.	TR	M	U	-		BP392		
Rhizopogon roseolus (Corda) Th. Fr.	TR	M	U	-		BP393	7626703	I-13 (8096600)
Rhizopogon rubescens (Tul. & C. Tul.) Tul. & C. Tul.	TR	M	U	KP399	8944776 **(ITS+nLSU: MT571667)**	-		
Rhodocollybia sp. (dark stipe caramel pileus)	MU	S	L	-		BP172	8565481	
Rhodocollybia sp. Leather brown (N.L.Bougher NLB1147)	MU	S	DW	KP080	8565414, 8565422, 8691126 **(ITS: MT536997; nLSU: MT524532)**, 8944679 **(ITS+nLSU: MT537101)**	-		
Rhodofomitopsis lilacinogilva (Berk.) B.K. Cui, M.L. Han & Y.C. Dai	BR	S	DW	KP275	7612664	BP148	7673825, 7650264, **7678878**	N-2 (**7678878**)
Rickenella fibula (Bull.) Raithelh.	MU	S	MG	-		BP395	8095728	J-27 (7679378)
Rickenella sp. Pearly, hygrocybe-like (N.L. Bougher E9358)	MU	S	L/BG	KP032	8476837 **(ITS+nLSU: MT537050)** 8476616 **(ITS+nLSU: MT537051)**, 8475644	-		
Russula balpinea (Grgur.) T. Lebel	TR	M	U	-		BP124	**7679645**, 7699166 **(ITS: MT537009)**	I-1 (**7679645**)
Russula eburnea (T. Lebel) T. Lebel	TR	M	U	-		BP247	7709757	
Russula erumpens Cleland & Cheel	MU	M	L	KP322	8630151	-		J-28 (no voucher)

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Russula lenkunya Grgur.	MU	M	L	-		BP399	7679254, 7679602, 7681089	
Russula marangania Grgur.	MU	M	L	KP164	8690731	-		
Russula sp. A (pink pileus, white stipe)	MU	M	L	-		BP398	7673809	
Russula sp. B (purple pileus, white stipe)	MU	M	L	-		BP401	7675569	
Schizophyllum commune Fr.	SH	S	DW	KP309		BP404	7589352	R-2 (7611838)
Scleroderma areolatum Ehrenb.	PF	M	L	KP220	7571321, 8872554	BP480	8871620	
Scleroderma australe Massee	PF	M	L	-		BP406		
Scleroderma cepa Pers.	PF	M	L	KP166		BP407	7551835	
Scutellinia scutellata (L.) Lambotte	CD	S	DW	-		BP409	7611870, **7679270**, 8094721	A-4 (**7679270**)
Scytinostroma duriusculum (Berk. & Broome) Donk	RE	S	DW	KP413	9105069 (**ITS+nLSU: MT537128**), 9105077 (**ITS+nLSU: MT537129**)	-		
Sebacina sp. (dirty white thin resupinate)	RE	S	DW	-		BP497	8871957	
Simocybe cf. *largispora* E. Horak	MU	S	DW	-		BP411	7681046	
Sistotrema sp. Grey paint on leaves (N.L. Bougher & P. Wenham NLB1402)	RE	S	DW	KP103	8478341	BP412	7675631, 8473846, 8871787 (**ITS: MT537018**)	

Sistotrema sp. Yellow flaps (N.L. Bougher E9396)	RE	S	DW	KP249		BP413	8475733	
Skeletocutis amorpha (Fr.) Kotl. & Pouzar	RE	S	DW	KP079	8565651, 8478333	BP414	8473579	
Steccherinum ochraceum (Pers. ex J.F. Gmel.) Gray	BR	S	DW	KP038	8475652	BP417	7612877, 8566585, 8871876	
Steccherinum sp. (resupinate with curtain-like surface)	RE	S	DW	-		BP521	8872236	
Stereum hirsutum (Willd.) Pers.	BR	S	B/DW	-		BP419	7658990	N-13 (8072701)
Stereum illudens Berk.	BR	S	DW	KP320	8476799	BP420		
Stereum rugosum Pers.	BR	S	DW	-		BP421		
Suillus granulatus (L.) Roussel	MU	M	L	KP349	7597320, 8690715	BP423	7588984, **8073163**, 8095795, 8871671	K-7 (**8073163**)
Talaromyces sp. (minute bright yellow pom poms)	CD	S	DW	KP392	8945004 **(ITS: MT537031)**	-		
Tapinella panuoides (Fr.) E.-J. Gilbert	MU	M	L	KP208	8691398	-		J-46 (8073759)
Thelephora sp. (black densely-branched cushion-like fruit bodies)	RE	S	DW	KP253	8873003, 8873011 **(ITS: MT537022)**	-		
Tomentella aff. *parmastoana* Suvi & Kõljalg	RE	M/S	DW	-		BP491	7678126, 8871795 **(ITS+nLSU: MT537073)**	
Tomentella pilosa (Burt) Bourdot & Galzin	RE	S	DW	KP310	8565643, 8478376, 8478392, 8944814 **(nLSU: MT554521)**	BP426	7678584, 7699107, 8072825	
Tomentella sp. A (brown felty)	RE	M/S	DW	KP430	8944806 **(ITS+nLSU: MT537108)**	-		
Tomentella sp. B (greyish-blue)	RE	M/S	DW	-		BP429	7675666, 7650116, 7699271	

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Tomentella sp. C (mauve)	RE	M/S	DW	KP431	9105050 (**ITS+nLSU: MT537127**)	-		
Tomentella sp. D (rusty)	RE	M/S	B	-		BP425	8475342	
Tomentella sp.E (tawny brown)	RE	M/S	DW	-		BP431	7679637	
Tomentellopsis echinospora (Ellis) Hjortstam	RE	S	DW	KP145	8478295, 8690650 (**ITS: MT536992; nLSU: MT524527**), 8691061	-		
Trametes coccinea (Fr.) Hai J. Li & S.H. He	BR	S	DW	KP307		BP358	7589123	
Trametes sp. (with maze-like pores)	BR	S	DW	-		BP150	7589395	
Trechispora aff. *farinacea* (Pers.) Liberta	RE	S	DW	KP160	8690642 (**ITS: MT537011**), 8944512 (**nLSU: MT524521**)	BP434	7699468, 8872228	
Trechispora aff. *microspora* (P. Karst.) Liberta	RE	S	DW	KP252	8872953	-		
Trechispora microspora (P. Karst.) Liberta	RE	S	DW	KP088	8565600	-		
Trechispora sp. (white resupinate with spiny surface)	RE	S	DW	-		BP435	8474923	

Tremella aff. *mesenterica* Retz.	JE	S	DW	KP319	8475229	BP437	7612885, 7589050, 7589212	Q-2 (no voucher)
Trichaptum cf. *biforme* (Fr.) Ryvarden	BR	S	B	-		BP433	7588917 (**nLSU: MT554522**)	
Trichoderma gelatinosum P. Chaverri & Samuels	CU	S	DW	KP226	8872694	BP112	**8073376**, 8566593, **8095744**, 8474869	D-4 (**8073376** & **8095744**
Trichoderma lixii (Pat.) P. Chaverri	CU	S	DW	KP315		BP202		D-5 (7678991)
Trichoderma sp. (bright yellow)	CU	S	DW	KP372	8944431 (**ITS: MT571668; nLSU: MT571668**)	-		
Trichoderma sp. (orange patches on wood)	CU	S	DW	-		BP201	8092427	
Trichoderma viride Pers.	CU	S	DW	-		BP200	8475121, 8566445, 8872147	
Tricholoma aff. *austrocolossus* Grgur.	MU	M	L	KP134	8478120 (**ITS+nLSU: MT537056**)	-		
Tricholoma austrocolossus Grgur.	MU	M	L	-		BP443	8473536 (**ITS+nLSU: MT537035**)	
Tricholoma eucalypticum A. Pearson	MU	M	L	KP183	8690928 (**ITS+nLSU: MT537059**)	-		
Tricholoma sp. A (faint red base, soapy odour)	MU	M	L	-		BP440	8473463	
Tricholoma sp. B (red-bruising, ant odour)	MU	M	L	-		BP441	8073724	
Tricholoma sp. C (no staining, no odour)	MU	M	L	KP181	8690871	BP439	8475547	

Name	Form	Life Mode	Micro Habit	Kings Park Code	Kings Park: herbarium (PERTH) barcode (and GenBank accession)	Bold Park Code	Bold Park: herbarium (PERTH) barcode (and GenBank accession)	Perth Field Guide page & voucher
Tricholomopsis scabra J.A. Cooper	MU	S	L	KP376	8944547 **(ITS+nLSU: MT537097)**	-		J-37 (no voucher)
Tricholomopsis sp. (yellow lamellae, brown-staining flesh)	MU	S	L	KP130	8478058 **(ITS+nLSU: MT537055)**	-		
Tubaria aff. *confragosa* (Fr.) Harmaja	MU	S	L/DW	KP092	8565627 **(ITS+nLSU: MT571664)**	-		
Tubaria furfuracea (Pers.) Gillet	MU	S	DW/L	-		BP190	8871728	
Tubaria serrulata (Cleland) Bougher & Matheny	MU	S	L	KP341	8473374	BP444	7680139	J-88 (7678886)
Tubaria sp. A (bright brown pileus, in woodchips)	MU	S	DW	KP107	8566267	-		
Tubaria sp. B (omphalinoid fruit bodies, in litter)	MU	S	DW/L	KP031	8476829, 8566003, 8630372, 8566526	BP532	8476683, 8565937	
Tubaria sp. C (on lawn grass)	MU	S	L	KP081	8565457, 8945063 **(ITS+nLSU: MT571665)**	-		
Tubulicrinis calothrix (Pat.) Donk	RE	S	DW	KP105	8872821, 8944466, 8944520, 8945055 **(nLSU: MT554523)**	BP446	7699476, 8474990, 8566151	
Tubulicrinis sp. A (grey smooth resupinate)	RE	S	DW	-		BP448	8477086	
Tubulicrinis sp. B (white smooth resupinate)	RE	S	DW	-		BP449	8474893	

Tubulicrinis sp. C (white thin smooth resupinate)	RE	S	DW	KP312		-		
Tylopilus fuscobrunneus Watling	MU	M	L	KP059	8630178, 8565155, 8478252, 8872759	-		
Uromycladium morrisii Doungsa-ard, McTaggart, Geering & R.G. Shivas	RU	P	DT	KP336	8945136 **(ITS: MT537033)**	-		
Volvopluteus gloiocephalus (DC.) Vizzini, Contu & Justo	MU	S	L	KP313	8872597	BP466		J-30 (no voucher)
Volvopluteus sp. (small fruit bodies with non-viscid grey pileus)	MU	S	DW	-		BP522		
Xenasma rimicola (P. Karst.) Donk	RE	S	DW	KP381	8944717, 8945152 **(ITS: MT571671)**	BP389	8092796, 8872090 **(ITS: MT537020)**	
Xerula atrocaerulea R.H. Petersen & Bougher	MU	S	L	KP384	8944695 **(ITS: MT537027)**	BP469	7342071	
Xerula gigaspora (Cooke & Massee) R.H. Petersen	MU	S	DW	-		BP468	8476667	
Xerula mundroola (Grgur.) R.H. Petersen	MU	S	L	KP357	8475202 (E9451	BP538	**7341989**	J-89 (**7341989**)
Xylaria sp. (white powdery asexual stage)	MO	S	L	KP369		BP470	8475369	
Xylodon aff. *asperus* (Fr.) Hjortstam & Ryvarden	RE	S	DW	KP003	8475210, 8473277, 8566569	-		
Xylodon aff. *flaviporus* (Berk. & M.A. Curtis ex Cooke) Riebesehl & Langer	RE	S	DW	KP329		BP405	7611889, 7673779, 8630259, 8871809 **(nLSU: MT524519)**	

Table 2. Slime moulds identified to species level from field surveys at Kings Park and Bold Park. See key in caption for Table 1 for explanation of the data in this table.

Name	Life Mode	Micro Habitat	Kings Park Code	Kings Park: herbarium (PERTH) barcode	Bold Park Code	Bold Park: herbarium (PERTH) barcode	Perth Field Guide page & voucher
Arcyria cinerea (Bull.) Pers.	S	DW	KP354		BP029		
Arcyria insignis Kalchbr. & Cooke	S	DW	KP087		BP030		
Arcyria obvelata (Oeder) Onsberg	S	DW	KP331		-		
Arcyria pomiformis (Leers) Rostaf.	S	DW	KP025		-		
Arcyria riparia L.G. Krieglst.	S	DW	KP229	9245162	-		
Ceratiomyxa fruticulosa (O.F.Müll.) T.Macbr.	S	DW	KP323	8475458, 8566313	BP056	**7679246**	Z-2 **(7679246)**
Collaria arcyrionema (Rostaf.) Nann.-Bremek.	S	DW	KP090		-		
Comatricha elegans (Racib.) G. Lister	S	DW	KP230		-		
Comatricha nigra (Pers.) J. Schröt.	S	DW	KP383	6872948, 9245197	-		
Diachea leucopoda (Bull.) Rostaf.	S	DW	KP131		BP131	7678835	Z-6 (no voucher)
Echinostelium minutum de Bary	S	DW	KP231	6873022	-		
Fuligo septica (L.) F.H.Wigg.	S	L	KP276		BP149		Z-4 (no voucher)

Licea kleistobolus G.W. Martin	S	DW	KP232	9245154	-		
Perichaena depressa Lib.	S	DW/ / L	KP380	9245189	-		
Physarum cinereum (Batsch) Pers.	S	L	-		BP324		
Physarum leucophaeum Fr.	S	L	-		BP325		
Physarum polycephalum Schwein.	S	L	-		BP326		
Physarum viride (Bull.) Pers.	S	DW	KP324		BP496		
Stemonitis lignicola Nann.-Bremek.	S	DW	KP061		-		Z-5 (no voucher)
Trichia affinis de Bary	S	DW	-		BP535	7678525	
Trichia decipiens (Pers.) T.Macbr.	S	DW	KP328		-		Z-3 (no voucher)
Trichia decipiens var. olivacea (Meyl.) Meyl.	S	DW	KP027	8474966	BP486		
Trichia persimilis P.Karst.	S	DW	KP011	8474591	-		
Trichia verrucosa Berk.	S	DW	KP020	8474974	BP438	8092818	
Tubifera ferruginosa (Batsch) J.F.Gmel.	S	DW	KP347		BP445	**8073716**	Z-8 (**8073716**)

SHOREBIRDS AT GREENOUGH RIVER ESTUARY AND SOUTHGATE BEACH, WESTERN AUSTRALIA

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ABSTRACT

The Greenough River estuary and Southgate Beach are part of a network of sites for migratory shorebirds. Our surveys from 2017 to 2020 show these sites support more than 200 shorebirds during the Australian summer. We recorded 20 of migratory shorebirds and nine species of Australian breeding shorebirds at the two sites. The most frequently observed migratory shorebirds were Red-necked Stint, Ruddy Turnstone, Sanderling, Grey Plover, Common Sandpiper and Common Greenshank. In addition, Australian breeding shorebirds were observed over summer; the most abundant were Black-winged Stilt and Red-capped Plover. This study is the first to recognise the significance of Southgate Beach to shorebirds. Our observations indicate Southgate Beach is nationally important for Ruddy Turnstone and Sanderling.

INTRODUCTION

Information about the shorebird populations at the Greenough River estuary and Southgate Beach is limited (Singor *et al.* 2019). The maximum number of migratory shorebirds observed at Greenough River was 132 and at Southgate Beach 164.

We have conducted counts over a number of years to gain an insight into the numbers and species utilising these sites and to assess their importance. The surveys were carried out by local birdwatchers who identified the prime locations used and helped collect data (Fig. 1). In the process we generated baseline data for these two locations. Reduced rainfall due to climate change is likely to impact on the water levels of Greenough River making the data collected relevant for future comparisons and monitoring. Geraldton's urban fringe is expanding towards the Greenough River, placing increased environmental pressures on both sites, making it important to identify the key shorebird sites.

SURVEY SITES

The Greenough River rises 240 km north-east of Geraldton on the Yilgarn Plateau and flows across the Waterloo Range. After emerging from this range, it flows to the north-west along a floodplain behind the coastal dunes to enter the sea at Cape Burney (28°51'11"S, 114°38'59"E), a small coastal town about 10 km south of Geraldton (Fig. 1; Brearley 2005).

The Greenough River estuary is usually closed by a sandbar and accumulations of seagrass which acts as a dam, affecting the water and salinity levels behind it. Although the sandbar does not break every year, it may break in winter or in summer. Once open, the bar will often remain so for several months (Brearley 2005). Salinity will rise in the river due to summer evaporation, sea water washing over the sand bar at high tides, and decline with the inflow of fresh water from rainfall or ground water seepage.

The estuary is 1.5–4 m deep and estuarine conditions probably extend for about 7 km upstream. The waters of the Greenough River and estuary are turbid, laden with sediment and eutrophic due to soil and fertiliser run off from agricultural land in the river's catchment (Brearley 2005). The banks are fringed with samphire which is quite dense in places. A narrow band of remnant native shrub vegetation grows on a limestone ridge that lines the

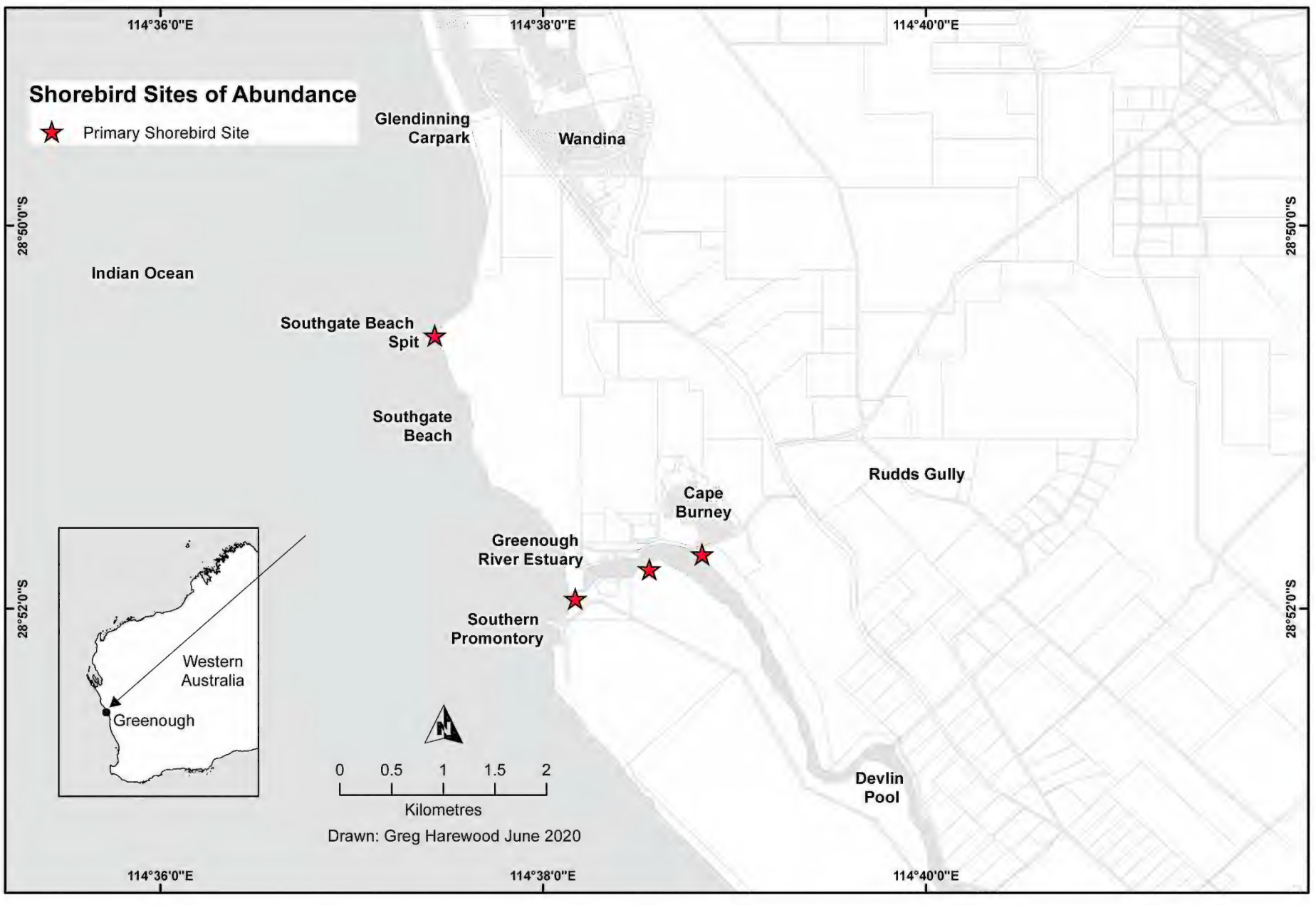

Figure 1. Location of study sites: Greenough River and Southgate Beach.

eastern bank. The first sharp bend upstream in the Greenough River is called Devlin Pool.

In August 2017, the Greenough River waters were right up to the sand bar and water levels extended into the samphire fringe leaving no shorebird habitat available. As the waters started to recede in October small parts of the shoreline became exposed and were soon occupied by Red-necked Stints and Red-capped Plovers. Heavy summer rainfall on 23 January 2018 caused the river to break through the sand bar and flow out to sea resulting in a drop in water levels and making shorelines accessible. The river entrance had closed again by the 9 March 2018. In late January 2020, the water levels in the estuary had dropped considerably due to summer evaporation. The shoreline extended out to the main river channel and the exposed banks consisted of a granulated limestone mud mixture with scattered rocky outcrops. Along the immediate shoreline was a fringe of samphire growth that transitioned to a belt of dried limestone and mud before changing to shallow mudflats and surface pools. Water had receded about 10 m from the riverbanks and the sandbar extended about 200–250 m across the river mouth. By May 2020, the water levels were slowly rising and had started to encroach on the samphire fringe as a result of recent rainfall. On 24 May 2020 storms caused the ocean to break through the sandbar and flood the riverbanks eliminating all suitable shorebird habitat.

North of the Greenough River estuary is Southgate Beach, a stretch of coastline consisting of a narrow beach strip sandwiched between shallow offshore reefs that extend up to the shoreline and a large ridge of dunes (Southgate Dunes; Fig. 2). It is often covered in banks of beach wrack which may be over 1 m high and 40 m long that are attractive to shorebirds (Payne & Hyndes 2013; Campbell 2018).

SURVEY METHODS

The Greenough River estuary was surveyed along both sides of the river between June 2017 and May 2020, a total of 57 surveys. Their frequency varied from one to five per month and were conducted by Linda Giblett and Alice Bishop, with assistance of volunteers. These surveys included the sandbar, the southern promontory, the adjacent beach, and the estuary pool behind the sandbar. The shorelines of the Greenough River were checked for shorebirds by walking the trail that follows the northern and eastern side of the river to Devlin Pool. Surveys were not conducted in October 2018 and January, February and May 2019.

The Southgate Beach surveys commenced more than a year later than those at the Greenough River estuary. The beach was surveyed on foot between October 2018 and May 2020. In total 40 surveys were carried out. The frequency of the surveys varied between one to three a month and were conducted by Alice Bishop. The

Figure 2. Southgate Beach showing narrow beach between dunes and reef. Photo by Alice Bishop.

Southgate Beach surveys started at the Glendinning carpark (Tarcoola Beach) which is at the northern end of Southgate Beach and proceeded southwards towards the mouth of the Greenough River and then returned back to the starting point (Fig. 1). The surveys were generally done in the early morning and when tides were low, though sometimes in the afternoon. On the return journey jetsam and other discarded materials were collected in an effort to keep the beaches in a pristine condition and counts were double checked.

OBSERVATIONS

Greenough River estuary

At the Greenough River estuary 20 migratory shorebird species and eight Australian breeding shorebird species were identified (Table 1). The highest shorebird counts of all species were 174 on 15 January 2018, 258 on 22 December 2019, 303 on 2 February 2020 and 281 on 12 April 2020.

The greatest number of migratory species seen during the survey period, was from November to March (Table 2). The first of the migratory shorebirds which arrived

Table 1. Maximum count of shorebirds at Greenough River estuary and Southgate Beach 2017–2020.

	Scientific Name	Greenough River	Southgate Beach
Migratory shorebirds			
Grey Plover	*Pluvialis squatarola*	9	12
Lesser Sand Plover	*Charadrius mongolus*	1	
Greater Sand Plover	*Charadrius leschenaultii*	5	7
Black-tailed Godwit	*Limosa limosa*	2	
Bar-tailed Godwit	*Limosa lapponica*	3	3
Whimbrel	*Numenius phaeopus*	3	1
Eastern Curlew	*Numenius madagascariensis*	1	1
Marsh Sandpiper	*Tringa stagnatilis*	1	
Common Greenshank	*Tringa nebularia*	18	2
Wood Sandpiper	*Tringa glareola*	2	
Grey-tailed Tattler	*Tringa brevipes*	2	3
Terek Sandpiper	*Tringa cinerea*	1	1
Common Sandpiper	*Tringa hypoleucos*	7	5
Ruddy Turnstone	*Arenaria interpres*	45	50
Great Knot	*Calidris tenuirostris*	1	2
Sanderling	*Calidris alba*	50	48
Red-necked Stint	*Calidris ruficollis*	76	94
Pectoral Sandpiper	*Calidris melanotos*	1	
Sharp-tailed Sandpiper	*Calidris acuminata*	3	2
Curlew Sandpiper	*Calidris ferruginea*	4	
Australian-breeding Shorebirds			
Australian Pied Oystercatcher	*Haematopus longirostris*		1
Sooty Oystercatcher	*Haematopus fuliginosus*	3	4
Black-winged Stilt	*Himantopus himantopus*	142	
Banded Stilt	*Cladorhynchus leucocephalus*	25	
Red-necked Avocet	*Recurvirostra novaehollandiae*	20	
Red-kneed Dotterel	*Erythrogonys cinctus*	1	
Red-capped Plover	*Charadrius ruficapillus*	123	120
Hooded Plover	*Thinornis cucullatus*	1	1
Black-fronted Dotterel	*Elseyornis melanops*	3	
	Total	28	18

in August was the Common Sandpiper. This was followed by Common Greenshank, Red-necked Stint, Grey Plover and Sanderling. The most numerous migratory species were Red-necked Stint, Sanderling, Ruddy Turnstone, Common Greenshank, Grey Plover and Common Sandpiper. Two Black-tailed Godwits were sighted on 12 March 2020 at Devlin Pool.

The most numerous Australian

breeding shorebirds seen during the survey period, were Black-winged Stilt and Red-capped Plover, and were most plentiful over summer and early autumn, with numbers of both increasing to in excess of 100 birds (Tables 1, 2). Black-winged Stilt were noted breeding on the west bank, upstream along the Greenough River (L. Giblett, pers. comm.). Banded Stilt were occasionally seen in small numbers, and Red-necked Avocet were seen over the summer months in a small flock of up to 20 birds. The Red-kneed Dotterel was a scarce visitor and only seen twice as a solitary bird. An immature Hooded Plover was seen on 23 January 2020 at the Greenough River estuary and remained there for about 3 weeks. Australian Pied Oystercatchers were not observed.

The greatest concentrations of shorebirds were at the southern promontory, south of the sandbar (Fig. 1) where there was often large amounts of beach wrack, favoured by Ruddy Turnstone and Sooty Oystercatcher. Other shorebird congregations were found in the southern corner of the estuary lagoon and shores upstream.

Southgate Beach

At Southgate Beach 14 migratory shorebird species and four Australian breeding shorebird species were identified (Table 1). The highest shorebird counts were 188 on 20 January 2019, 234 on 10 November 2019 and 172 on 8 March 2020.

The greatest number of migratory species were seen from September to March (Table 3). The first of the migratory shorebirds to arrive in September were Ruddy Turnstone, Sanderling and Red-necked Stint, and they stayed until May. They were present in small flocks of between 10 to 40 birds. Grey Plover and Greater Sand Plover stayed at Southgate Beach from September till May with Grey Plover numbers of five to 12 birds and Greater Sand Plover of four to seven birds. There were a few sightings of single Bar-tailed Godwit.

The most numerous Australian breeding shorebirds seen during the survey period, were Red-capped Plover which were seen almost all the year-round, with numbers exceeding 100 birds in May, October and November (Table 3). The Australian Pied Oystercatcher was a scarce solitary visitor and only seen three times during the surveys. The Sooty Oystercatcher was seen over the winter months, generally in small numbers of one to two.

Concentrations of shorebirds were found at the Southgate Beach spit which is about 2 km south of Glendinning car park. In 2019, the continuation of summer conditions throughout autumn and into early winter extended the availability of suitable habitat at Southgate Beach. There were several sightings of over-wintering shorebirds during this period, e.g. Grey Plover (June, July), Bar-tailed Godwit (June, July), Ruddy Turnstone (June) and Red-necked Stint (June) (Table 3). At low tide the shorebirds fed on the exposed reef.

Table 2. Maximum monthly count of shorebirds at Greenough River estuary, June 2017 to May 2020. Key: * no observations.

Month	2017 6	7	8	9	10	11	12	2018 1	2	3	4	5	6	7	8	9	10	11	12
Migratory shorebirds																			
Grey Plover		*				7	8	6	3	1	1						*	5	6
Lesser Sand Plover		*															*		
Greater Sand Plover		*									1						*	4	5
Black-tailed Godwit		*															*		
Bar-tailed Godwit		*															*		
Whimbrel		*															*		
Eastern Curlew											1								
Marsh Sandpiper		*															*		
Common Greenshank		*		1	2	7	13	8	11	1	3	4					*		2
Wood Sandpiper		*															*		
Grey-tailed Tattler		*				1	1	1									*		1
Terek Sandpiper		*															*		
Common Sandpiper		*	1	6	2	7	7	7	4	3	1				1	2	*	1	4
Ruddy Turnstone		*						18				3					*	6	6
Great Knot		*					1										*		
Sanderling		*						10		1	1						*	7	10
Red-necked Stint		*			2	11	32	65		44	16	10					*	3	6
Pectoral Sandpiper		*															*		
Sharp-tailed Sandpiper		*							1								*	1	
Curlew Sandpiper		*															*		
Australian-breeding Shorebirds																			
Sooty Oystercatcher		*															*		
Black-winged Stilt		*			10	10	12	18	73	6	39	22				2	*		2
Banded Stilt		*						2			7						*		
Red-necked Avocet		*					3	1									*		
Red-kneed Dotterel		*					1										*		
Red-capped Plover	10	*			6	6	24	71		15	26	32	10	6			*	15	43
Hooded Plover		*															*		
Black-fronted Dotterel		*									3	1					*		
Total species	1		1	2	5	7	10	11	5	7	11	6	1	1	1	2		8	10

Table 2 (cont.)

Month	2019 1	2	3	4	5	6	7	8	9	10	11	12	2020 1	2	3	4	5
Migratory shorebirds																	
Grey Plover	*	*	2		*					1	3	6	2	9	6	5	7
Lesser Sand Plover	*	*			*									1			
Greater Sand Plover	*	*			*							2	1	1		1	
Black-tailed Godwit	*	*			*										2		
Bar-tailed Godwit	*	*			*						1	3	2				
Whimbrel	*	*			*					2	2	1	3	3			
Marsh Sandpiper	*	*			*											1	1
Common Greenshank	*	*	5		*	1				3	4	11	18	9	5	4	5
Wood Sandpiper	*	*			*							2					
Grey-tailed Tattler	*	*			*						1	2					
Terek Sandpiper	*	*	1		*						1	1					
Common Sandpiper	*	*			*			1	2	1	2	4	1	4	3		
Ruddy Turnstone	*	*			*									18	1	45	8
Great Knot	*	*			*												
Sanderling	*	*			*							8		50	5	2	16
Red-necked Stint	*	*			*					50	56	60	64	70	65	76	55
Pectoral Sandpiper	*	*			*								1	1	1		
Sharp-tailed Sandpiper	*	*			*							3	1	1	1		
Curlew Sandpiper	*	*			*											4	1
Australian-breeding Shorebirds																	
Sooty Oystercatcher	*	*			*											3	3
Black-winged Stilt	*	*	29	3	*	5	1		2	21	15	42	83	80	80	125	142
Banded Stilt	*	*	25		*									6			
Red-necked Avocet	*	*			*						6		20	18			
Red-kneed Dotterel	*	*	1		*							1		1			
Red-capped Plover	*	*	80	2	*			5	10	19	12	123	90	100		20	16
Hooded Plover	*	*			*									1			
Black-fronted Dotterel	*	*	1		*									1		1	
Total species			8	2		2	1	2	3	7	11	15	12	18	10	12	10

Table 3. Maximum monthly number of shorebirds present at Southgate Beach, October 2018 to May 2020.

	2018			2019												2020				
Month	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
Migratory shorebirds																				
Grey Plover	2	5	8	7	6	9		5	4	6		5	10	12	11	8	11	6	5	7
Greater Sand Plover		4	5	6	6	5		1				4	5	7	6	4	5	4		1
Bar-tailed Godwit				1				1	1	1							3	1		
Whimbrel														1						
Eastern Curlew				1																
Common Greenshank			2																	
Grey-tailed Tattler			1									2	3	2		1				
Terek Sandpiper													1							
Common Sandpiper	5	3	3	5	5							2	4	2	2	2	2			
Ruddy Turnstone		6	6	6	11	19	4	12	1			50	24	16	2	26	45	40	6	7
Great Knot												2	2	1	1	2				
Sanderling		7	7	21	42	40		11				5	7	48	6	39	17	19		8
Red-necked Stint		3	8	57	65	22	12	15	1			10	27	68	2	30	32	94	3	51
Sharp-tailed Sandpiper				2																
Australian-breeding Shorebirds																				
Aust. Pied Oystercatcher							1			1							1			
Sooty Oystercatcher								4	1	2		1							1	1
Red-capped Plover		15	43	92	32	45	50	100	68	42	22	70	100	120	60	51	74	14	29	35
Hooded Plover									1											
Total species	2	7	9	10	7	6	4	8	7	5	1	10	10	10	8	9	9	7	5	7

The highest monthly counts of migratory and Australian breeding shorebirds are shown in Fig. 3.

Leg-flagged birds

A Red-necked Avocet was seen on 7 January 2020, at the Greenough River estuary with a yellow leg-flag, engraved with the letters DP. This bird had originally been flagged at Boiler Point, Roebuck Bay, Broome on 7 August 2013 (C. Hassell, pers. comm.) and was sighted at North Lake, Perth on 7 June 2019. The distance travelled between Broome and Perth is about 2000 km following the coastline.

A leg-flagged Grey Plover, seen at Southgate Beach, had been flagged in Japan. An orange leg-flagged Red-necked Stint, originally leg-flagged in Victoria, was sighted on 20 January 2019. These sightings provide evidence of the large distances migratory shorebirds travel.

DISCUSSION

Suitable wetlands, staging areas and mudflats for shorebirds have been declining globally (Studds *et al.* 2017) making the preservation of any shorebird sites in Western Australia a priority. There are limited stopovers available along the mid-west coast (Singor *et al.* 2019; Bishop *et al.* 2020). Our surveys of the Greenough River estuary and Southgate Beach highlight the importance of these sites as migratory destinations for shorebirds over the Australian summer; the importance of the Southgate Beach spit to shorebirds was not previously recognised (Fig. 3). These beaches are covered with

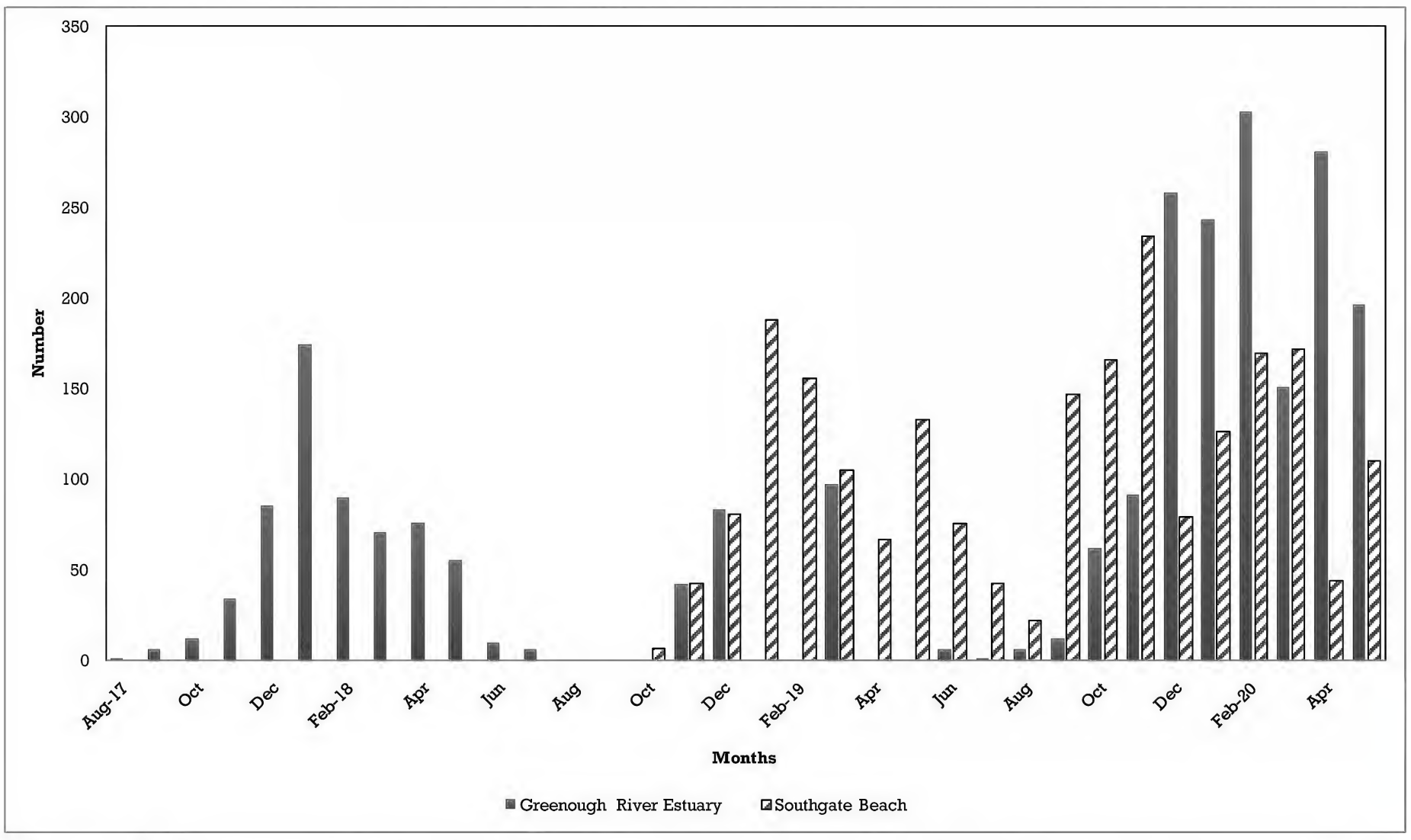

Figure 3. Comparison of highest monthly counts of all shorebirds present at Greenough River estuary and Southgate Beach 2017 to 2020. Southgate Beach surveys were commenced in October 2018.

prolific beach wrack providing a resource for shorebirds in a region where wetlands and mudflats are limited in extent. The seasonality of accumulations of beach wrack varies along the west coast but is most prolific during the summer and autumn months (Wells 2002; Singor 2018), the time most shorebirds are present.

For a shorebird site to be nationally important under the Wildlife Conservation Plan for Migratory Shorebirds, it needs to regularly supports 0.1% of an East Asian-Australasian Flyway population of any migratory shorebird species (Hansen *et al.* 2016). Southgate Beach meets the flyway population criteria to qualify as a nationally important site for Ruddy Turnstone (30) and Sanderling (30). Overall, the Greenough River estuary and Southgate Beach do not meet the criteria of internationally significant shorebird sites based on population numbers (Bamford *et al.* 2008). However, both locations form part of a network of minor sites that support shorebirds as conditions vary through the year.

The impacts of climate change need to be considered as it may affect both sites. A drying trend has been most evident in the southwestern corner of Australia (Bureau of Meteorology 2016). The drying trend is particularly strong between May and July over southwest Western Australia, with rainfall since 1970 around 20% less than the average from 1900 to 1969. Since 1999, this reduction has increased by around 26% (Bureau of Meteorology 2016). This has the potential to change the water regime in the Greenough River which in turn determines the amount of exposed shoreline that is available to shorebirds. Greenough River water levels are controlled by both summer (tropical lows) and winter rains. Under normal conditions water levels drop over summer providing suitable foraging habitat for visiting shorebirds. In early June 2018, however, heavy winter rainfall caused the water levels in the Greenough River to rise to such an extent that the mudflats and samphire fringes were flooded. Shorebirds along the estuary disappeared and only a few Red-capped Plovers were present on the beach. The sandbar was not breached on this occasion.

A reduction in the inflow of water resulting from reduced rainfall has the potential to dry out shorelines for extended periods making them unsuitable for shorebirds. Poor water quality associated with the dry season conditions were the probable reason for the Greenough River fish deaths in January and March 2020. These events are likely to impact on the river invertebrates, a food source for shorebirds. It is not known how a rise in sea levels will impact on Southgate Beach though the rise will amplify the effects of high tides and storm surges. Any changes in beach wrack distribution and volumes will impact on the shorebird populations (Campbell 2018).

In addition, there are recreational pressures at both sites from several sources. At Southgate Beach these are from recreational vehicles, fishermen, motorbikes, quad bikes, boats and dogs. At the Greenough River estuary there are similar factors at play, such as fishermen, vehicles, dogs and motorboats. Four-wheel drive vehicles are driven along the riverbanks, across the sand bar all the way to the southern promontory. These activities prevent any successful breeding events taking place. These intrusions need to be managed to ensure both the Greenough River estuary and Southgate Beach maintain their conservation value and the disturbance factors to shorebirds are kept to a minimum.

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OBITUARY

DAPHNE JOAN (CHOULES) EDINGER
13 DECEMBER 1927 – 18 MARCH 2020

Daphne Edinger, a former Western Australian Naturalists' Club president, was born in the Naval Maternity Hospital in Portsmouth, England during a snow storm. Her father Chief Petty Officer Claude Choules was stationed in England to prepare and deliver HMAS *Canberra* to the Australian Navy. Claude would achieve international acclaim in 2010, aged 110, when he became the world's last living combatant of World War 1. His autobiography 'The last of the last', compiled by Daphne, was published in 2009.

Claude and his wife Ethel Sim Wildgoose, a trained children's nurse, had met onboard the passenger ship SS *Diogenes* in 1926, when Claude was being transferred on loan, for two years, to the Australian Navy. In 1926 Claude transferred to the Royal Australian Navy and in December of the same year he and Ethel were married in Melbourne.

Daphne's early years were spent in North Sydney where her father taught her to swim at the tidal swimming baths at Lavender Beach where she developed a love for the ocean. A sister Anne was born in 1929 and a brother Adrian in 1934. The family moved to Perth in 1931 and bought an old 1920's brick house 'Bredon' in East Fremantle,

Figure 1. Daphne Edinger.

built by a Merchant Navy sea captain.

Being a sailor's daughter involved many maritime adventures. In 1933 the family travelled on the *Kybra*, a small motor driven State Ship on a 14-day return trip to Fortescue Island off the Pilbara coast. During the Second World War the family remained in Fremantle as Daphne's father was responsible for naval demolition for Western Australia. In the event of Western Australia being attacked by Japan, it would have been one of his tasks to blow

Figure 2. Daphne Edinger at Rottnest Island in August 1947, aged 19.

up the port and the other facilities. There were day trips to Rottnest Island when her father ferried the District Naval Officer to the Port War Signal Station. Summer school holidays were spent under canvas at Coogee Beach, south of Fremantle. Here Daphne sailed the *Titmouse*, a dinghy she had helped her father and brother build. Daphne recalled that her father, an old sea-dog, would never swear in front of the children and should such a need ever arise he would yell "Ethel, send the children away!"

Both parents wanted their children to be well educated. Daphne attended Girton College, a short-lived girl's school, in High Street, Fremantle before attending Presbyterian Ladies College. After completing her matriculation Daphne studied music and chemistry at Perth Technical College before enrolling at The University of Western Australia in 1946. Her desire to study medicine was not to be realised as the post-

Figure 3. The Edinger family's summer holiday getaway 'Rock Cod Retreat' on Garden Island.

Figure 4. Edinger family on Garden Island with Engelbert the Carpet Python. (L-R Malcolm Edinger, Ted Lawn, Robert, Daphne, (at front) Louise and Andrew Edinger).

war influx of returning service personnel meant priority had to be given to them. Daphne majored in zoology and under the supervision of Dr Ernest Hodgkin obtained her Bachelor of Science degree with Honours for her thesis on 'The Ecology of the Western Australian Limestone Reefs'. Loisette Marsh who was also doing her honours degree on echinoderms alongside Daphne, remembers their field work on the intertidal reefs at Rottnest Island. She and Daphne would stay at the cottages at Thompson Bay and ride their bikes, loaded with survey equipment, to their research site at West End. Loisette recalled one summers day, when the temperature reached over 42 degrees Celsius as they rode their bikes the 12 kilometres to and from West End, happy on the way back to fall into the nearest salt-lake to cool off.

In 1950, Daphne joined the WA Department of Agriculture in South Perth as an entomologist.

Figure 5. Biology teacher Daphne Edinger at Presbyterian Ladies College in 1978 with staff members Vicki Anderson and Barbara Godwin (Image: Lindsay Croker, PLC Archives).

Figure 6. Kevin Kenneally and Daphne Edinger processing plant specimens at the Sale River, West Kimberley in 1986 (Image: Kevin Coate).

This career was short-lived as in 1951 she married John Edinger, an industrial chemist. Public service regulations at that time required her to resign, a practice she regarded as highly discriminatory towards women. At the family home in Bicton she raised four children, three sons (Robert, Andrew and Malcolm) and a daughter Louise.

School holidays were spent on Garden Island where Daphne and her father instructed the children in all things nautical. Accommodation was a shack built in 1958 by John Edinger and his brother-in-law Steve Spence, aptly named 'Rock Cod Retreat'. Here the children could roam freely on the island, swimming, fishing and investigating the wildlife under their mother's guidance. Tammar wallabies and a carpet python named 'Engelbert' (after the English pop singer Engelbert Humperdinck), became frequent visitors to the shack, much to the

Figure 7. Kevin Kenneally, Daphne Edinger and Tim Willing in Canberra at the 1996 presentation award for the CSIRO Medal for research achievement. (Image: Kevin Kenneally).

Figure 8. Daphne's Triggerplant (*Stylidium daphne*) was named to honour her contribution to Western Australian botany. (Image: Allen Lowrie).

children's delight. Crayfish and fish were always on the menu.

As the children grew older Daphne returned to Presbyterian Ladies College as head teacher of biology. Daphne was on staff from 1967–1972 and 1974–1982. She was adored by her students and remembered as an inspirational, energetic and hip teacher. Former student Caroline McKenzie wrote "I will remember her as a warm, fun, stylish, kind, intelligent, spirited and dynamic person".

Her marriage to John ended in 1975. In 1979 Daphne joined the Australian and New Zealand Scientific Exploration Society (ANZSES) and participated in their inaugural trip to the Fitzgerald River National Park. After her retirement from teaching in 1982 she was a botanist with the popular Westrail Wildflower Bus Tours. In 1983 she joined a month-long ANZSES expedition to Walcott Inlet in the West Kimberley. On this expedition she met botanist Kevin Kenneally from the Western Australian Herbarium, a specialist on Kimberley vegetation and plants. It was on this trip that Daphne asked Kevin if he ever needed assistance with his research. The rest, as they say, is history. Daphne volunteered as a full-time research assistant with Kevin and was the first person in 1986, to be offered an Honorary Research Assistant position by the then Curator Dr John Green, that gave her all the privileges of a staff member. For the next 20 years she would devote her life to assisting Kevin and other botanists at the Herbarium with their research projects.

Figure 9. Loisette Marsh and Daphne Edinger on a Naturalists' Club excursion to Mount Churchman in the Great Western Woodlands in 1990 collecting the poorly-known granite mallee *Eucalyptus educta*. (Image: Kevin Coate).

In 1988, Daphne was invited by Principal Research Scientist Norm McKenzie to be a member of the research team surveying rainforest patches in the Kimberley as part of the Federally funded National Rainforest Conservation Program. In 1996, she was a joint recipient (with Kevin Kenneally and Tim Willing) of the CSIRO External Research Medal for Excellence for the project and book 'Broome and Beyond. Plants and people of the Dampier Peninsula, Kimberley, Western Australia'. In 2000, Daphne joined Kevin, Jean Paton and Cheryl Tonts at Landscope Expeditions, a citizen science program conducted jointly between UWA Extension at The University of Western Australia and the Department of Conservation and Land Management (CALM) and participated as a leader on many of the expeditions to remote areas of Western Australia.

In 1990 she received an Outstanding Service Award from Dr Syd Shea, the Executive Director of CALM for her long-term volunteer contribution to the Western Australian Herbarium. In 2007 she was awarded Conservation Volunteer of the Year by the then Minister for the Environment, David Templeman, for her outstanding contribution 'as a botanist and volunteer' to the Landscope Expedition's research program.

In 2007 and 2008 Daphne, accompanied by retired engineer and Western Australian Herbarium volunteer Gilbert Marsh, joined botanist Bruce

Figure 10. Helen Aston (26.03.1934 – 17.03.2020) botanist and ornithologist (National Herbarium of Victoria), Daphne Edinger and technical officer Phil Spencer pressing specimens of *Cycnogeton dubium* at Bobby's Creek near Beagle Bay on the Dampier Peninsula in April 1988.

Maslin's field team assisting with his taxonomic and genetic population sampling of Mulga wattles (*Acacia aneura*) in the Pilbara, Goldfields, Murchison and Ashburton Regions. In 2004 she and Gilbert assisted ecologist Mark Cowan with vegetation and flora surveys of the Black Range and Lake Mason, two adjoining former pastoral stations in the Murchison Bioregion.

In amongst her botanical work Daphne found time for weekly family dinners and accompanying her son Andrew, one of the four licensed shell collectors, on diving expeditions along the coast. She took her grandsons Keenan and McLane Edinger to sleepovers at the Herdsman Lake Wildlife Centre and assisted Kevin with botanical collecting and teaching at the WA Gould League annual year 6 Science Camp School at the Bickley Outdoor Recreation Camp.

Daphne was a Council member for ten years and President of the WA Naturalists' Club from 1995 to 1996. During her term as president Daphne organised a number of excursions often with

Figure 11. Daphne Edinger and Kevin Kenneally (two former presidents) had over 20 years working together on the flora of Western Australia, in particular the Kimberley.

the assistance of Club stalwart Kevin Coate. She also participated as a leader on a number of these long-range Club excursions including the Kimberley Coast (1984), Dampier Peninsula (1988), East Kimberley (1989), Mount Churchman (1990), Goongarie and Carnarvon Range (1999), Thailand (2000) and the Kimberley Camp-Out to Kingston Rest in 2001. Daphne was also a foundation member, in 1993, of the Kimberley Society and became its inaugural secretary.

During her over twenty years of field work Daphne contributed 403 collections as the sole collector and over 7,000 plant specimens with other collectors to the Western Australian Herbarium. To date, nine of her collections were species new to science and have been named and designated types, by Australian botanists (Table 1). The majority of them have a conservation-listing designating they are poorly known, poorly collected or geographically restricted. Daphne's valuable contribution to botany, all in a volunteer capacity, was recognised in having two plants named in her honour: Daphne's Mulla-Mulla (*Ptilotus daphne*) and Daphne's Triggerplant (*Stylidium daphne*). She was the co-author of a number of important botanical papers.

Daphne's contribution to botany and conservation, particularly her work in the Kimberley and Murchison was outstanding. Kevin Kenneally said he was extremely fortunate to have had Daphne's assistance and companionship for such a long time. She was intelligent, extremely diligent and was happiest sleeping under the stars in her swag or processing thousands of plant specimens in the Herbarium. Daphne would scramble up sandstone escarpments searching for plant specimens, endure the myriad bites of green ants when collecting in Kimberley rainforests and suffer numerous sandfly bites when investigating mangroves, but nothing deterred her. Always attired in her hallmark black Akubra hat, she greeted everyone with her booming "Hello darling!" Daphne was an intrepid, inspiring and unforgettable person whose warmth and good humour was appreciated by all who met her. Her significant contribution to conservation and botanical science will be her enduring legacy.

Daphne is survived by her brother, four children, eight grandchildren and one great grandchild.

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Table 1. Plants collected by Daphne Edinger designated as type specimens.

Family	Genus	Species	Author	Cons Code	Collector	Coll Number	Coll Date
Amaranthaceae	Ptilotus	chrysocomus	R.W. Davis	1	D.J. Edinger	Nats 66	28/08/1999
Goodeniaceae	Goodenia	crenata	Carolin & L.W. Sage	3	D.J. Edinger	1416	7/05/1999
Amaranthaceae	Ptilotus	daphne	Lally	1	D.J. Edinger	Nats 58	28/08/1999
Cyperaceae	Caustis	deserti	R.L. Barrett	3	D.J. Edinger	1019	18/10/1995
Lamiaceae	Anisomeles	farinacea	A.R. Bean		D.J. Edinger	496	28/06/1987
Myrtaceae	Calytrix	hislopii	Rye	3	D.J. Edinger	5498	19/09/2005
Chenopodiaceae	Tecticornia	papillata	K.A. Sheph.	1	D.J. Edinger	Nats 61	28/08/1999
Lythraceae	*Nesaea* (current name *Ammannia*)	striatiflora	Hewson		D.J. Edinger	334	9/06/1987
Lamiaceae	Dicrastylis	subterminalis	Rye	1	D.J. Edinger, B. Backhouse & G. Marsh	DJE 2128	17/05/2000

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Kevin F. Kenneally
School of Agriculture and Environment &
Department of Geography and Planning
The University of Western Australia

OBITUARY

ALEXANDER (ALEX) JOHN SAAR
(1942–2019)

Dear Alex, I have just completed my Ph D in Evolutionary Ecology and want you to know that it all began in your classroom where you inspired me and opened my eyes to the natural world.

This brief note written by a former student some years ago, encapsulates, in a few words, the legacy left by Alex – his ability to impart to others the desire to learn and understand the world around them.

Alex was a member of the Western Australian Naturalists' Club for almost 65 years and a science teacher for more than 40 years. His interests were vast, from A to Z. He was interested in astronomy and how the earth was created, in weather and climate, in geology and geography, and in all things living, from botany to zoology. He read scientific publications prolifically. He just wanted to know how everything in the natural world worked. He was fascinated by the interconnectedness of things; the way apparently different biological systems depended on one another or influenced one another. He just had to know. He was a lifelong learner. He had a tremendous knowledge of plants and also the fauna of Western Australia and beyond. He was particular about nomenclature and taxonomy.

Alex Saar, 2017. Photo by Helen Burkin.

Every plant must be known by its correct botanical name, because those Latin or Greek names yielded useful information about the plant and avoided confusion with others.

Alexander John Saar was born on 1st September 1942. His mother Eva emigrated from England with her family when she was a young girl. His father was born in a small village in Estonia and went to sea in his teens, eventually ending up in Perth, after 'walking ashore' from a four masted sailing ship, the *Carradale*, possibly around 1915.

Alex was brought up to be inquisitive about the world

Alex exploring Labyrinth Cave, 1973. Photo by Paul Caffyn.

around him, to value books and education, to appreciate a wide range of music and to develop many of the values that he held throughout his life. He never sought attention and was never a spendthrift, unless it came to books, music and bromeliads.

Alex was only 14 when his father died, a couple of years after he entered Mt Lawley High School in 1955 as one of its founding students, a badge he wore proudly. Also in his class was Gane Doyle, who was to become a life-long friend and companion on many excursions. Gane recalled, "It was at high school that Alex and another classmate, Alan Eades, became interested in boomerangs and perfecting their flight, so much so, that on one occasion while practising on the reserve at the corner of Woodrow Avenue and Alexander Drive, Alex's returning boomerang scored a perfect hit, bouncing off Alan's head". Despite their homicidal tendencies, boomerangs continued to be one of Alex's life-long interests.

When Alex left high school there were not the financial resources available to enable him to attend university. He had to make some decisions about his future so he attended Claremont Teachers College, the first step towards a career that lasted more than forty years. A university degree, completed part time, came years later.

His teaching career began as a primary teacher at Dianella Primary School in 1962. As he lived close by he was able to walk to work, no doubt observing the array of flora and fauna which then still existed in the suburban bushland. However this all changed a couple of years later when he inherited his Uncle Sid's green Holden station wagon. While others were modifying engines or practising wheelies, his first act on taking possession of the car was to build a book case at one end to house his reference collection of books on botany, insects, birds and animals. The car and books were all he needed, along with some basic camping equipment, for what became his regular weekend trips to the bush or coast in pursuit of nature.

In 1970 he moved to Mirrabooka Senior High School to take up a role as a maths and science teacher. In this role, as was the practice at the time, he enthusiastically collected biology specimens for classes when possible, which sometimes extended to road kill, and was not without some scary moments. One day when returning home from a caving weekend down south with three friends, he spotted a lifeless Gould's monitor on the side of the road. He decided that this dead fellow would be an excellent addition to the biology lab specimens and got out the large calico bag he carried for just such serendipitous finds. The monitor was duly bagged and placed at the very rear of the station wagon, behind all the luggage and sleeping bags. Some 20 minutes later a large lizard head appeared in the rear vision mirror. After a sudden braking manoeuvre and quick exit from the vehicle, the four men retreated a few metres and waited. After another 20 minutes the lizard dislodged itself from under the driver's seat and headed for the bush, never to be seen again.

Alex returned to his alma mater, Mt Lawley Senior High School, in 1975 as senior science teacher and remained there until his retirement in 2007 by which time his responsibilities had expanded to include teaching computer science.

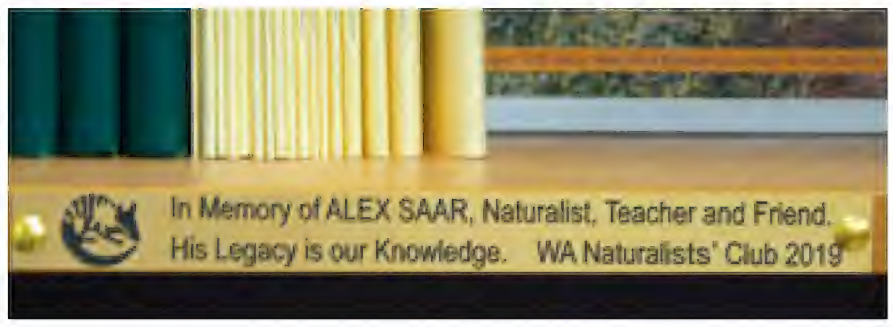
His interest in natural history began at a very early age. Club member Joy Dell (nee Nietfield), grew up opposite Alex in Sixth Avenue, Inglewood and recalled when a child, the Saars' neighbour saying to her mother, "Do you know young Alex Saar has got a snake in the backyard?" His thirst for knowledge lead to him joining the Western Australian Naturalists' Club as an Intermediate member in the mid 1950s, no doubt inspired by the young Harry Butler, who was to become a friend and mentor.

Alex graduated to Seniors in 1959. He served on the Council in 1962–63 and held the position of Joint Honorary Librarian in 1972–74 following a self-funded course on librarianship. For many years, pre the computer and printer era, he prepared the labels for displays at the annual Wildlife Show, all done using Letraset.

In 1984, as one of the few members to have access to a personal computer, he offered to "type" Rica Erickson's manuscript, *History of the Western Australian Naturalists' Club (1924–84)*. He retained fond memories of Rica and in early August 2008 drove up to the Rica Erickson Nature Reserve, between Wannamal and Calingiri, and photographed every flowering plant he could find. He then had the photos printed into an album, along with suitable text, and presented it to Rica so that she could see what was flowering on her hundredth birthday, on the reserve named after her.

Alex was a Life Member of the club and almost up to the time of his death, was a regular attendee at meetings of the Main Club, the Northern Suburbs Branch and the Retired and Leisured Group.

Unveiling of memorial plaque. L to R Don Poynton (Chairman NSB), Helen Burkin, Leigh Thomas and Jolanda Keeble (President, WA Naturalists' Club). Photo by Bob Ruscoe.



If he did not have something to show or report, which was rarely, he brought along a book surplus to his requirements to give away to another member. Generous in deed, knowledge and time.

In 1956 a number of cave explorers formed a club and as 16 of the 18 members were already members of the Naturalists' Club there was no difficulty in accepting them as the Speleological Group in 1958, with Alex taking on the role of Publicity Officer, a job he excelled at. During the club's Wildlife Shows, he was often to be found hanging by a rope suspended from the rafters of the Perth Town Hall as he demonstrated caving techniques to wide-eyed school children.

During the 1960s and 70s he was very active in caving in Western Australia and on the Nullarbor, serving as President of the WA Speleological Group in 1965 and 1970. He and his friend, the late Lindsay Hatcher, made several paleontological discoveries including the fossilised remains of some of Australia's long extinct mega fauna. Their finds have since made their way into the Western Australian and South Australian Museums and also a number of scientific publications.

One extinct animal in particular fascinated Alex, *Thylacinus cynocephalus*, the Tasmanian Wolf or Tiger. In September 1996, using notes he and Lindsay had originally prepared in 1986, he set up his own web page to highlight the 60th anniversary of the death of the last animal in captivity. He

maintained and updated the page whenever he came across new information or received reports of sightings.

Although Alex didn't write articles for publication himself, he generously shared his knowledge at meetings and during numerous short and extended excursions. Bob Willis recalled, "During a club excursion to Burnabinmah Station, north of Paynes Find at Easter 1997, the station switched off the only source of power, a diesel generator, at 9 pm, leaving members in pitch darkness. But instead of heading to bed, we spent the next 30 minutes spellbound as Alex took us on a journey through the night sky, pointing out Mars, the constellations, the Milky Way, bringing it to an end by pointing out the Coalsac Nebula".

A year earlier, on the 1996 June long weekend excursion to Dryandra State Forest members received an unexpected and hilarious lesson in male squamate (snakes, lizards and worm lizards) physiology after Alex chased and caught a Gould's monitor. It was the first time many members had heard of, let alone seen, two hemipenes!

While all his fellow naturalists knew of his passion for nature, sharp wit and quirky, sometimes macabre, sense of humour, there was another side to Alex that few knew; a love of music. Joy Dell recalled Alex taking piano lessons from a teacher who lived next door to her. From these lessons he was able to teach himself the piano accordion, an instrument that accompanied him on many club excursions and to camps on Rottnest Island in the 1970s while a volunteer leader with the YMCA. His taste in music was eclectic. Those closest to him say he could listen to the rowdiest rock music or appreciate works from the classical repertoire. While he didn't like to celebrate his own birthday, there are stories that for many years he staged a party on the 16th December, the date generally accepted as being Beethoven's birthday!

Alex had a passion for all aspects of natural history. In addition to the Naturalists' Club he belonged to the Gould League, the Insect Study Group, Friends of Mirrabooka Bushland and was a member of the Bromeliad Society for decades (and the proud owner of over 5000 plants at one stage). He had an active interest in fungi and loved to go on fungal forays in winter. He contributed observations to the Fungi Map project and answered countless questions on a fungi information website.

As Helen Burkin, his partner of more than 30 years, recalled at a small gathering of friends a few weeks after his death, "The natural environment was a place that held spiritual qualities for him. When the pressures of life were making their presence felt, a few days or a weekend in the bush – the more remote the better – rejuvenated him. It was the passion that surpassed all others. I have seen him in the middle of Paris with his camera pointing not at Notre Dame, but at a nearby tree where there was a particularly attractive bracket fungus that

really did need to be photographed. I have seen him on his knees in the grounds of the Kremlin in Moscow, not aiming his camera at the gold onion domed buildings glinting in the sunlight, but at a colourful beetle passing by on foot. On the battlefields of Gettysburg he was beside himself because he really wanted to hear the history being described, but there were just so many enormous fungi at his feet, and he hardly knew which way to turn".

In 2012, Alex and Helen reluctantly made the decision to move from the home they had built in bushy Darlington 22 years earlier, to a smaller block in Stirling, not that far from Inglewood where Alex grew up. In retirement Alex embraced the change and nearly every day did a three kilometre walk around the lakes close by, taking a keen interest in the bird and aquatic life on his doorstep. He developed a positive relationship with people at the City of Stirling, at times advising them about invasive fish species in the lakes, along with invasive plants that were duly removed.

Alex passed away on the 18th March 2019 after enduring treatment for oesophageal cancer for several years. Typical of "no fuss Alex", he requested no funeral or memorial service be held. He left behind his beloved Helen and is survived by his two daughters, Erin and Leigh and four grandchildren.

In January 2020, Helen and Leigh joined other club members at the unveiling of a small memorial plaque in the library of the Henderson Environment Centre, North Beach, the meeting place of the Northern Suburbs Branch of the WA Naturalists' Club. The plaque is attached to a shelf containing Alex's collection of *The Western Australian Naturalist.*

Prepared by Don Poynton from material kindly supplied by Helen Burkin with contributions from numerous Nats members, especially Joy and Eddy Dell, Gane Doyle and Bob Willis.

Silver Gull *Chroicocephalus novaehollandiae* blue eggs – Blue eggs of Silver Gull *Chroicocephalus novaehollandiae* were found and collected on Penguin Island (32°18'20.3"S, 115°41'26.1"E) near Perth under DEC licence no. TF5113 on 9 October 2009. These blue eggs are unusual (Fig. 1) typically eggs are green (Fig. 2). The Silver Gull uses the island for nesting: I observed 84,001 Silver Gulls over 60 surveys from Aug 2008 to April 2012 (mean 1,400 gulls per survey) and only saw blue eggs on this occasion. The number of nests were not counted but were numerous across the whole island. Silver Gulls were confirmed attending the nest and incubating the blue eggs. I postulate that the female bird had lost the ability to generate yellow to colour the eggs green. Such unusual coloration points to the ability of Silver Gulls to evolve egg colour in a different direction. The eggs were deposited in the Western Australian Museum.

– GRAHAM R. FULTON, Centre for Biodiversity and Conservation Science, University of Queensland, Brisbane, Qld 4072; Environmental and Conservation Sciences, Murdoch University, South Street, Murdoch WA 6150.

Figure 1. Unusual blue eggs.

Figure 2. Typical green eggs.

VOLUME INDEX

Volume 31 – Part 1: 1–65; Part 2: 67–113;
Part 3: 115–190; Part 4: 191–283

GENERAL

Obituary: Margaret Helen Brims 182

Obituary: Alexander (Alex) John Saar (1942–2019).....275

Obituary: Daphne Joan (Choules) Edinger.....265

BIRDS

Avifauna of Underwood Avenue Bushland, Shenton Park, Western Australia 11

Extension of counts of Carnaby's Cockatoo (*Calyptorhynchus latirostris*) at two overnight roosting sites in metropolitan Perth 67

First Australian specimen of Fairy Pitta (*Pitta nympha*) with notes on its distribution and migration 128

First Western Australian specimen of House Swift (*Apus nipalensis*) with notes on its distribution and migration 105

Honeyeaters taking Marri sap on Gooseberry Hill 115

Shorebirds at Greenough River estuary and Southgate Beach, Western Australia.....252

Silver Gull *Chroicocephalus novaehollandiae* blue eggs.....281

FUNGI

Fungi and Slime Moulds recorded in surveys at Kings Park and Bold Park – urban bushlands Perth, Western Australia 191

INSECTS

The first nesting observations of a potter wasp *Rhynchium superbum* (Vespidae, Eumenidae) – a recent eastern invader inhabiting the suburbs of Perth Western Australia.....1

Intra and interspecific interactions involving *Meroglossa rubricata* at bee blocks in urbanised south-western Australia.....82

PLANTS

A limestone subspecies of *Petrophile brevifolia* Lindl. (Proteaceae).....7

Evidence of pollination by sexual deception in the endangered spider orchid *Caladenia williamsiae* 36

Flora of the Swan Coastal Plain Foot-hills Part 2: Bancell Road Reserve.....44

Weedy and natural distribution of *Acacia trigonophylla* (Fabaceae).....53

Time to maturity in the Zamia Palm *Macrozamia riedlei*.....63

Ursinia nana DC (Asteraceae) is naturalised in Western Australia.....78

Swan Coastal Plain studies: Taxonomic notes on *Bossiaea eriocarpa* Benth. and *Bossiaea ornata* (Lindl.) Benth. (Bossiaeeae: Fabaceae)....95

Swan Coastal Plain studies: Status of the subspecies of *Grevillea curviloba* McGillivray (Proteaceae): a critically endangered plant.....119

A rare subspecies of *Apium prostratum* L. (Apiaceae) from Western Australia.....133

Flora of the Swan Coastal Plain Foot-hills Part 3: Vascular flora of Korijekup Conservation Park, Harvey.....137

Flora of the Swan Coastal Plain Foot-hills Part 4: Vascular flora of the Yarloop townsite reserves 159

REPTILES

Basking behaviour in Tiger Snakes, *Notechis scutatus* (Elaphidae) at Herdsman Lake, Western Australia.....89

Communal basking by Tiger Snake *Notechis scutatus* and a Bobtail *Tiliqua rugosa*.....113

An unusually coloured Tiger Snake, *Notechis scutatus* (Elaphidae) from Herdsman Lake, Western Australia 180

Evidence of plastic consumption by a Tiger Snake (*Notechis scutatus*) from a highly urbanised wetland 187

AUTHORS

Abbott, I. 11
Barrett, M.D. 191
Berry, P.F. 67
Bishop, A. 252
Bougher, N.L. 191
Brooker, M. 115
Brown, A. 119
Brundrett, M. 53
Budrey, B. 113
Davison, E. 182
Dell, J. 63
Dell, P. 63
Fulton, G.R. 281
Greatwich, B. 105, 128
Hart, R. 182
Johnstone, R.E. 105, 128
Keighery, B. 7, 44, 78, 119, 137, 159
Keighery, G. 7, 44, 53, 78, 95, 119, 133, 137, 159
Kenneally, K.F. 265
Knight, K. 182
Lettoof, D. 187
Longman, V. 53
Orange, P. 89, 113, 180
Orton, K. 187
Owen, M. 11, 67
Phillips, R.D. 36
Poynton, D. 275
Prendergast, K. 1, 82
Singor, M. 252
Swann, G. 128

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Excursions and field days are planned from time to time and will be advertised in the Club's monthly newsletter "The Naturalist News" and is available under 'Events' on our website.

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